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VIEWS, NEWS AND INTERVIEWS.

Since the burning of the Opera Comique, at Paris, in 1887, it has been the effort of nearly all French theatrical managers to adopt a speedy means of lowering the iron curtain in an instant, and electricity has been found to supply the demands of both the managers and public for shutting off instantly any fire occurring on or about the stage from the audience. The first theatre in Europe known so far to use the electric iron curtain is the Comédie Français, at Paris. The curtain is hung by four steel wire ropes which run over pulleys, the ropes then meeting at and going over a wooden drum. This is driven from the pulley by an electric motor.

A well known architect and engineer tells the *Sun* that it will not be long before all the public balls and theatres are ventilated in the same way as Carnegie Music Hall. At present this building is unique, in that it is supplied with air through perforations in the roof, the exhaust taking place through the "risers" under the seats. The air can be supplied so fast that the freshness and temperature are kept nearly at the normal, and the gallery, instead of being the worst place in the house, is the best, in so far as it is close to the air supply. This mode of ventilation is only possible, however, where electric lights are used, for the heat generated by gas causes the foul air to rise and an escape for it must be found in gallery windows or the roof.

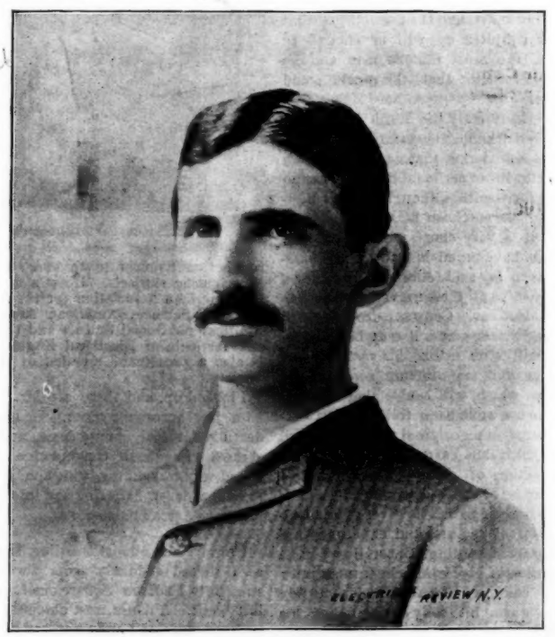
The news that General Eckert has been elected president of the Western Union Telegraph Company, says *Kate Field's Washington*, has an indirect interest for Washingtonians, due to the fact that he learned the art of telegraphy from an operator who is now one of Washington's prominent and most respected citizens. Mr. S. H. Kauffmann, one of the proprietors of the *Evening Star*, began his career as a telegrapher in an Ohio town more years ago than you would suspect from his youthful and sprightly carriage to-day. One of his duties was to instruct a young apprentice named Eckert. Both men have made a success of life, each in his own field, and probably no one received the news of General Eckert's latest advancement with more genuine pleasure than the man who taught him his trade.

Thomas Barnes, a colored man, extinguished several hundred electric lights in Cairo, Ill., by a singular accident on March 15. He was assisting in placing an additional dynamo in the power house of the Delta Electric Company, when his foot slipped, and he fell headforemost into the fly wheel pit through a narrow opening made for the belt. His head struck the belt, knocking it from the fly wheel and instantly stopping the dynamo. He fell directly under the swiftly revolving fly wheel, which cleared him by only a few inches, and remained there until the machinery could be stopped. He sustained only the slightest injuries.

A new kind of telephone wire is being experimented with in Germany, consisting of an aluminium-bronze core with a copper-bronze envelope. It is said to have a low resistance and to have great tensile strength.

Last week the United States Supreme Court decided a case that is far-reaching in its effects. The case in question arose in a fight the city of St. Louis made against the pole nuisance in the streets. That city attempted to levy a tax on each pole, and the Western Union Telegraph Company fought the case. But the Supreme Court has decided that a city has full control of its streets, has the right to say what shall or shall not be placed on them, and has the right to levy a tax of $5 or any other amount on each and every pole that stands in the public highway within the city's limits.

Dr. A. H. Phelps, the inventor of the tool for engraving upon glass, illustrated in a recent number of the REVIEW, has formed a stock company, to be known as the Glens Falls Electric Engraving Company. He intends purchasing material to enable him to furnish an exhibit for the World's Fair.



NIKOLA TESLA,

THE EMINENT YOUNG ELECTRICIAN.

Weston Electrical Instrument Company.

The handsome factory of the Weston Electrical Instrument Company, at 114 William street, Newark, N. J., is one of the cleanest, best-equipped and most successfully operated electric manufacturing plants which it has been the good fortune of the writer to visit. Here the well-known Weston measuring instruments are made, and the methods of manufacture remind one of a watch factory on a large scale. About 100 skilled hands are employed, and the equipment of special tools for the accurate work which the construction of the Weston instruments demands is of great value.

The factory is being run to its full capacity to supply the ever-increasing demands for Weston instruments, a large number of which will be used in the World's Fair installations. The Weston Electrical Instrument Company has secured a space 26x36 feet in the gallery of the Electricity Building at the World's Fair, and will make a remarkably handsome showing of their products.

Mr. Charles D. Shain, of 136 Liberty street, New York, the general sales agent of the company, is turning in orders at a great rate, and is assisting to a considerable degree in spreading the fame of the Weston instruments. Prof. Weston devotes his personal attention to the manufacture of these devices in all details, and this is doubtless one reason for their phenomenal success.

NIKOLA TESLA.

A PSYCHOLOGICAL AND SCIENTIFIC STUDY OF THE MAN.

I can confidently state that Nikola Tesla is one of those few productions of nature that have been termed geniuses. His individuality is assertive, and his presence elevates. One cannot converse with him without feeling that peculiar influence which he exerts. His mind is the embodiment of concentrated and continuous thinking. Thinking is his life, his pleasure, and the practical realization of his thoughts is his happiness. It is not possible to conceive of a happier mortal, for his seeking and achieving happiness are instantaneous, and therefore continuous. He is always thinking, and in his flights of imagination there is nothing which is impossible, nothing which cannot at some time be realized.

His passion for the new is intense. Naturally of an extremely emotional disposition, his nerves are constantly on a fearful tension. His will-power also is enormous. While a youth of 18 years he used to, as a source of amusement to himself, cause his heart to stop beating, solely through the powerful influence of his will. It is possible that he might have killed himself in the course of time had he not been advised by his physicians that this practice was extremely dangerous, and by its continuance he would forfeit his life.

A man of thoroughly excellent habits and morals, straight-forward, good-hearted, generous, honest and unselfish, he may be properly termed an ideal gentleman.

Business men of to-day, and especially Americans who are thoroughly in touch with the ideas of American progress, cannot put themselves in his place. He is perfectly independent, for he has no desire for pecuniary compensation. His work is above price, for it is with him the great incentive of life. He will not attempt anything that has been started by another. He is original. His line of action is entirely in the path of his thoughts, and his thoughts are so unlike what is generally imagined to be the outcome of a practical man's reasoning that his work is considered marvelous. It is marvelous. But the fact that it is so considered by others is a source of real annoyance to him. He is intensely modest, and this, looking at his general character, is not surprising.

The national and popular fame that he has acquired in the past few years is distasteful to him. He thinks that successful men are only original when they work on a restricted scale, and are unhampered by the many cares attending the control of a business or large laboratory. He feels that the glamour that surrounds popular success is merely superficial. All very great inventions and discoveries are the children of those lovers of nature who have worked as

"minute philosophers." As soon as outward cares come, progress is hindered, and even a family, as Bacon says, "is a hostage to fortune." So this man, untrammeled by domestic duties, and comparatively young, has a brilliant future before him which only unforeseen circumstances can mar.

Sir Isaac Newton, when asked how it was that he could solve such difficult problems, answered, "I simply hold the thought steadily before my mind's eye until a clear light dawns upon me." So it is with Nikola Tesla, who projects and revolves the subject in his mental field of vision. He has power to concentrate his mind on the subject in hand to such an extent that it is merely a matter of time when all the mists of uncertainty clear away, and the object of his thought looms up clear, comprehensive and practical.

Whenever he goes upon the lecture stage he believes implicitly that every one of his audience must know more about the subject than he does. This is the cause of his diffidence. He dislikes anything like show, and above all that any one should look upon him in the light of one claiming to do something supernatural. It is said that during several of his lectures superstitious people have left the hall, believing that he was in league with the evil one.

Mr. Tesla's power of concentration makes him desire solitude, and his laboratory and workshop are sealed books to the outer world. He is so constituted that unless he is insulated from the world his trains of thought, which his assistants zealously guard, are liable to be shunted. He, therefore, only receives his friends outside of his workshop. His latch key hangs outside of his home. His fellow workmen he makes his friends, and in all the time that he has been experimenting for himself, but one of his employés has left him, and that one returned in a very short time.

His experiments are carried on at his own expense, and to the layman they would seem, as they really are, the essence of originality. As soon as some new line is commenced his genius asserts itself, and he starts out on the new field prepared to discover. His talents are not so much in an inventive line as in the field of discovery, for he does not like to finish what another has commenced. Only that which was hitherto unknown will he attempt. His ideas are so numerous and come in such rapid succession that he never attempts to put them down. One day, for the sake of a trial, he jotted down his thoughts as they came. This he found to be so inconvenient that almost his entire time, of course outside of his moments of thought, were taken up in transcribing. His memory is wonderful, and, though words may escape, ideas never leave him.

In his laboratory, which is a modest retreat, he employs six workmen, all of whom are thoroughly skilled in their different lines, and he himself is a practical and thorough mechanician, many of his earlier lamps and bulbs having been made entirely by himself. He takes up but one thing at a time, and is so utterly oblivious to all that surrounds him that it seems, as he says, that there is nothing in the world for him outside of what he is thinking of; and that, were a person to communicate with him on any subject foreign to his direct line of thought, they would imagine that his intellect was below the average. But as soon as he finds these apparently foreign thoughts have direct bearing on the subject in hand, then it is that they instantly become a part of his reasoning, and he is as proficient in them as if he had made that particular line the study of his life.

He comes from a very old family, who are descendants of the ancient Slavs, they having settled on the borders of Austria, on a small strip of territory called Lika. There are few people from the place of his birth in America. Boschowitz is a countryman of his. His father and mother were both great lovers of nature. His sisters, three in number, are all highly intellectual, the youngest especially being considered quite a genius. It had often been discussed among the members of his domestic circle who was the most promising in the family. The preference was always given to this youngest sister. She is tall, strong and remarkably heavily built. Before Nikola earned his world-wide reputation he took second place in the family, but now his sister, whom he still modestly thinks is far superior to him in every way, has been relegated to second place. His life has been full of vicissitudes, and it was these very difficulties which made his success.

When he gets an idea that a thing is possible he starts out with all enthusiasm, and works day and night with no rest, until he gets on the path which he believes leads on to the solution.

When a child he would wait anxiously for bedtime to approach, not that it might bring sleep and rest to his youthful mind, but that he might lay abed the whole night thinking and pondering over some pet idea.

Ever since he first saw the Gramme machine, with its complicated commutator, he believed, in fact, knew, that he could make a machine which would do without this expensive accessory. He was laughed at for his pains, but, no matter, history repeated itself, and he solved the problem, producing what is now known as "Tesla's motor."

That he is resourceful may be determined by any one who chooses to advance to him some apparently impossible problem. Like a flash he will have some reasonable explanation, and if the subject is of enough importance to him he will not rest until he sees that it is either possible or impossible. If it is possible, he will obtain the solution; if impossible, it will be cast off like an old garment and he starts again on some new idea within the realm of possibility.

He has theories for the solution of all difficult problems that occur in daily life, but the grand scheme ever constant in his mind, and which he implicitly believes will be solved by him, the transmission of electrical power without wires, has attained such proportions that he feels sure its solution is not far distant. All his energies are bending toward it, and the possibilities that this idea conjures up will be enough to make him the most famous man and the greatest benefactor that the world could ever have.

He speaks fluently the Latin languages, and has remarkable conversational ability.

He has a moderate income, all of which he puts into his experimenting. He has no yearning for wealth, although he feels positive that if he so chose he could be independent in a very short while. Many of his friends have urged him to go into business so as to lay aside enough money for a rainy day. To all these urgent pleas he has turned a deaf ear. Constant dropping will wear away a stone, and it may be possible that he will soon utilize his vast store of experience and manufacture some of his apparatus, which will enable those electricians who are anxious to follow in his footsteps to start in on original experimenting, and by that means carry out plans, such as the perfection of details, which can but should not be considered by a master mind.

The descriptions that he gives of his feelings during his lectures and experimenting are intensely interesting. Generally when he is through with his lectures he is in an utter state of collapse. These high frequency currents warm his body and quicken his nervous action.

His recent celebrated lecture was not of such benefit to the electrical fraternity as it should have been, owing to the immense size of the hall, and that outsiders were admitted, and that the spectacular had to give place to the scientific. But in all his experiments he essays to illustrate some particular fact, new and useful, and if electricians are fortunate enough to hear another lecture by him at the World's Fair, the mistake of admitting the non-technical public should not occur again.

The photograph which accompanies this character description shows him as he is when passive, but it is impossible, without talking to him, to imagine the look of supreme intelligence which asserts itself in every line of his face. His deep set eyes add to the appearance of continual intense thought, and, taking his face all in all, it unmistakably evinces the hidden genius that lies beneath its surface. J. A. M.

THE WEEK IN NEW YORK.

A KEEN OBSERVER'S DIARY OF THE PAST SEVEN DAYS IN THE METROPOLIS.

Work detained me at my office late last Monday night, and after I had finished I swam across the muddy stream formed by Broadway, Park Row and the elements, to get something to eat at the Astor House. This old hostelry has recently been rejuvenated, and now presents a very modern appearance. Proprietor Allen has installed electric lights, which add much to the effect of the new frescoing on walls and ceilings.

While eating in the café, I finished reading my morning's *Recorder*. This paragraph caught my attention:

Few lawyers are more successful in patent cases than Charles L. Buckingham, of the Western Union building. Mr. Buckingham is a representative of the Buckeye State, where he was born in 1852. He is an alumnus of the University of Michigan, where he studied the profession of civil engineer. Subsequently he turned his attention to the law and graduated from the Columbian Law University, of Washington, D. C. His first effort after his admission to the bar was in the field of patents. His scientific training proved of great value to him, and he instantly became prominent as a patent lawyer. When he came to New York a few years ago his ability attracted the attention of the Western Union officials, and he has been extraordinarily successful in defending the patent rights of that corporation. He is also the attorney for a number of other big electric concerns. Mr. Buckingham is a regular contributor to *Scribner's Magazine* on scientific subjects. He is a member of the American Association for the Advancement of Science, American Academy of Political and Social Science and the American Institute of Electrical Engineers. He is also a prominent member of the Ohio Society.

I looked up, and there sat Mr. Buckingham just across the room. He has a wonderfully forceful countenance, and a keen, shrewd visage. In conversation with the friend who was dining with him, he proved to be that most flattering and interesting of persons—a good listener.

I received an almost startling impression as I turned suddenly from Twenty-third street into Madison Square one foggy night last week. A dense mist obscured the outlines of buildings and trees, but over in the direction of the *Cosmopolitan Magazine* building a reddish glow suffused the heavens. Looking up there met my gaze in two lines of living fire the words

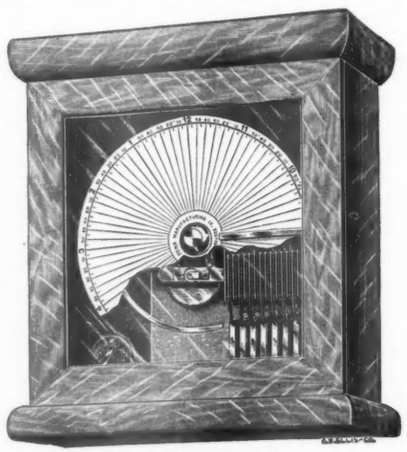
ADMIRAL
CIGARETTES.

The electric sign seemed to be hanging in mid-air and my first impression reminded me of how that old Biblical heathen must have felt when he saw the hand-writing on the wall. These electric lighted signs are most effective advertising, and I should judge that perhaps 200,000 people a night are startled by this one.

Last Sunday was a warm, spring-like day. St. George's Church, in Stuyvesant Square, would have been uncomfortably warm were gas used instead of electric lights. By the way, the lighting of this church is remarkably good and is accomplished with very few lamps, considering the size of the building.

I find that a great many electrical people from out of town like to stay at the Hotel Imperial, although others patronize the Hoffman House. At the latter hotel I found Mr. R. T. McDonald, general manager of the Fort Wayne Electric Company, who is a reputed millionaire, all from electricity, who will remain in New York for a week or so. George Cutter, of Chicago, is at the Imperial, conferring with Major Everts about Simplex wire, in which both men are deeply interested.

The electric dance which Miss Dorothy Denning is now performing at Koster & Bial's seems to be popular with the people. The effect produced would be more artistic were the dancer more lithe and graceful. She is a large, stout woman, and the bodice and trimmings of electric lamps which she wears serve to apparently increase her size. Current is supplied from the mains in the building through a flexible cord attached to the dancer's back. The Electric Construction and Supply Company, 18 Cortlandt street, prepared the electrical accessories for this spectacle. VOLTABOUT.



THE IONA WATCHMAN'S REGISTER.

The Iona Watchman's Register.

We illustrate herewith a recently improved watchman's register which is being put upon the market by the Redding Electric Company, of No. 41 Federal street, Boston.

Mechanically and electrically, this register is a very high class instrument, all the parts being made with great accuracy, highly finished and neatly designed, and enclosed in polished dust-proof cases in various natural woods. The novel features of this Iona system consist mainly in the gravity operating mechanism combined with a printing record made by magneto operated magnets.

This arrangement is found to give the best practical results, after a long experience and careful tests.

The printing feature makes a record that cannot be counterfeited, imitated or effaced, while avoiding all danger of tearing the dial. The magneto system does away with all annoyance attending the use of batteries.

Time movements are furnished when required with the Iona register at a small extra cost.

This system has already found favor with the insurance companies, who recommend its use and materially reduce rates wherever it is installed.

Flood at Schenectady.

A flood inundated the works of the General Electric Company at Schenectady, N. Y., last week, and it was at first feared that the company's World's Fair exhibit had been destroyed and that the loss would reach $500,000. The plant was again in operation at noon on March 14, and it is now said that the damage will be from $25,000 to $50,000, mostly for loss of time and expense of drying wet apparatus.

The Opinion of the Large Majority.

TO THE EDITOR OF ELECTRICAL REVIEW:

Enclosed please find draft to renew my subscription to the ELECTRICAL REVIEW. I could not be without it.

Wishing the ELECTRICAL REVIEW continued success, I am, as ever, truly,

(Signed) J. M. WOODS.

Knightstown, Ind., March 12, 1893.

THE INCANDESCENT LAMP.

PROF. EDWARD WESTON'S REMARKS BEFORE THE ST. LOUIS CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

The modern incandescent lamp consists essentially of three elements—the carbon conductor, the glass envelope and the leading-in wires. These are the essential elements of the lamp as the art exists to day. The older incandescent lamps contained these same elements arranged in substantially the same manner; for you will find in nearly every case the carbon conductor or its equivalent, the glass envelope surrounding it and protecting it from the influence of the atmosphere to a certain extent; and thirdly, the leading-in wires or their equivalents adapted to carry the current to the conductor, to be raised to a high degree of incandescence by the current.

The creators of the art of electric lighting—and I speak in this way because I do not think it fair to disregard the work of everybody who has preceded us—I say that the creators of the art of electric lighting understood the subject a great deal better than a great many people have given them credit for.

The fact that the incandescent lamp played so small a part in practical work until a comparatively recent period does not warrant us neglecting to give due credit to the early workers. This is true of all arts, but it is particularly true of the art of electric lighting, since, as a matter of fact, the methods and means now employed in making lamps and producing light by them are very similar to those employed by the early workers, and the essential elements of the present lamps are substanially identical with those of the early workers. Furthermore, the principles upon which the operation of the modern lamp depends are precisely the same as those involved in the early lamps, notwithstanding recent decisions. Indeed, the fact that no incandescent lamp was commercially used until a recent date is not due to the causes generally ascribed, but to other causes, almost, if not wholly, overlooked by writers on the subject. The writers on the subject so far may, in my opinion, be divided into two general classes:

1. Writers who have attained distinction in some other branch of scientific work, many of whom are apt to express their opinions rather hastily, and without due consideration of the principles involved, on the possibility or impossibility of the application of some single scientific fact or a number of such facts to a useful art. Such writers always abound, and generally express their opinions fully, in a very authoritative way, whenever a new industry begins to attract attention.

2. Writers whose opinions are based on sentiment or who are biased or interested, and are, therefore, frequently unable to look at things fairly or reason logically.

The former class of writers are generally honest, and firmly believe that they have good grounds for the opinions they form and express. Of the other class, those who are influenced by sentiment only deserve our consideration; but those writers who either wilfully close their eyes to the facts in the history of the art, or have no knowledge of the history, or wilfully endeavor to pervert the facts and seek to manufacture history, deserve the fate which will surely befall them.

Among the first class of writers you may remember that a number of distinguished scientific men expressed very strong opinions on the absolute impossibility of economically subdividing the electric light, either arc or incandescent. What they said at that time was accepted by many as gospel truth. Two notable instances of the kind, which will serve to show how unwise it is to prophesy unless you carefully study the subject and take into consideration all the facts, ought to serve to make scientific men more careful. The two instances I refer to are those of the French electrical engineer, Mr. Hippolyte Fontaine, and the well-known English electrician, Mr. H. Preece. The former is well known from his early work in connection with the introduction of the Gramme machine and its use in electric lighting. Mr. Preece has for many years been chief electrician of the English telegraph service.

Mr. Fontaine was a strong advocate of the arc light, and of that system which necessitates the use of a separate generator for each lamp, and was engaged in the effort to generally introduce such a system.

He had little faith in the success of any other system of arc lighting, and practically none in the possibility of success with the incandescent system.

Mr. Fontaine made a series of experiments on incandescent lamps, grouped in series and also grouped in parallel. The current to operate these lamps was derived from voltaic batteries variously grouped. In these experiments a rough effort appears to have been made to ascertain the strength of the current used with a single lamp, or a number of lamps, in circuit, and the value of the illuminating power of the lamps was apparently roughly determined under the different conditions of grouping of batteries and lamps. But the experiments were wholly misleading for several reasons. In the first place there was no absolute determination of the strength of the current, no determination of the difference of potential at the terminals of the lamps, and, consequently, no determination of the energy required to bring a single lamp or a group of lamps to a certain candle-power.

The experiments were, therefore, of the crudest character, and wholly insufficient to enable any one to draw any conclusions regarding the economy of the incandescent light, or the possibility or impossibility of economically subdividing it.

It may be truly said that the whole of the experiments were misleading, and were evidently conducted without even an elementary knowledge of the simple principles involved in the subdivision of the electric light, whether arc or incandescent.

Mr. Preece attacked the matter from a similiar point, and fell into errors fully as great if not greater than those made by Fontaine. He wrote an elaborate mathematical paper on the subject, which was published in one of the oldest and best scientific journals in the world, and it was republished in many of the best scientific and engineering journals of the world, and the substance of the paper was embodied in nearly all the books published on the subject of electric lighting, and was endorsed by the authors of such books as an extremely valuable paper. The paper had the approval of many scientific men; it had the stamp of authority, and passed current as sterling gold, so to speak. In it he, from dynamical considerations, mathematically demonstrated the impossibility of economically subdividing the electric light, either arc or incandescent. Notwithstanding this (with all due respect to Mr. Preece), the paper did not embody the truth; on the contrary, the whole mathematical reasoning was founded on error, and a misconception of the elementary principles involved in the production of the electric light.

I believe it will serve a useful purpose and be of some interest to examine these experiments and conclusions rather closely, and to show where the mistakes of these and other writers of about the same period, arose.

Do you conceive it possible that a man will be so foolish as to suppose that if he put a kettle containing two gallons of cold water on the fire that it would take no more heat to raise that two gallons of cold water to a temperature of 212 degrees than it would take to raise one gallon to the same temperature? Does it not appear reasonable to suppose that almost any schoolboy who has passed through the curriculum of one of our high schools would be able to answer that question correctly, and at once, without resort to any mathematical formula? Is it not perfectly clear to the mind of any one in this room that it would require at least twice the heat or work to be done on two gallons of water to raise it to a given temperature as would be required to bring one gallon of water to the same temperature? Substitute for water another form of matter, and is not the answer necessarily the same? Furthermore, substitute for heat any other form of energy, and is not the answer necessarily the same? Of course, it is. Simple as these facts may appear, they embody the fundamental principles of the electric light, and its subdivisions, whether it be arc or incandescent.

Substitute for the water and the kettle a mass of carbon equal to one-tenth of an ounce, and so proportioned and disposed as to permit it being brought to a sufficiently high temperature to become highly luminous, or incandescent, by heat from any other source of energy. Measure the energy expended in maintaining its luminosity or degree of incandescence constant. Now split this one-tenth of an ounce of carbon into 10 equal parts, lengthwise or crosswise, and arrange them so that the 10 equal parts can be made to constitute 10 separate luminous centers. It is manifest that we shall have 10 parts of carbon each equal to one one-hundreth of an ounce.

Now, let them each be subjected to heat from any source of energy sufficient to raise the temperature of each of the 10 small masses to the same point as that to which the large mass was raised, and which they originally composed. Does it not follow, as a matter of necessity, that each mass of $\frac{1}{100}$ of an ounce will require substantially $\frac{1}{10}$ of the energy applied to the large mass to bring it to the same temperature, and that each of the 10 small luminous centers will give a light substantially equal to $\frac{1}{10}$ of the light of the large mass, and that, consequently, the light from the whole of the 10 small masses will be substantially equal to the light of the large mass which they originally constituted?

Broadly speaking, these are the principles involved in any system of illumination, and of necessity, they apply to electric illumination, either by arc or incandescent.

It must be admitted, however, that in actual practice, large lights are somewhat more economical than small ones, and the reasons for the greater economy of large lights is and was perfectly understood long before the date of Mr. Fontaine's experiments and Mr. Preece's paper. If these principles are so simple, how is it that there has been so much mystery and misconception in regard to this subject? How is it possible that men like Mr. Preece should have used such language as appears at the end of the elaborate mathematical paper referred to; language which unquestionably denies the possibility of the economical subdivision of the electric light?

The explanation of the error is that Mr. Preece assumed that when lamps were introduced in series in the circuit, there was an increase in the total resistance of the circuit which diminished the current flowing, and he failed to perceive that to overcome the increased resistance in the series of lamps, and bring each of the lamps in series to the same degree of luminosity, as was the case when only one was in circuit, it was only necessary to increase the electromotive to such an extent as to force through the circuit of two or more lamps in series the same amount of current as was needed to bring a single lamp to its normal degree of brilliancy, or normal candle-power, if you prefer it.

Surely if a certain amount of energy was needed to obtain a light of certain candle-power, it ought not to require more than twice that amount of energy to run two lights each of the same candle power as the single light, and so on in the same proportion. Mr. Preece utterly failed to grasp the simple fact that if a certain amount of energy was needed to raise a certain lamp to a certain candle-power, two such lamps require twice the amount of energy, and if two or more such lamps were put in series, it was necessary, in order to deliver the amount of energy required by each lamp to bring it to its normal candle-power, to increase the electromotive force of the generator in simple proportion to the number of lamps in circuit.

In discussing the multiple arc system, he made an equally serious mistake, and made the remarkable statement that *"the total amount of heat generated in the resistances will vary inversely as the number of the latter in circuit."* Now, everyone of you know, and every electrician should know, that just the opposite is necessarily true, for with a suitable battery or dynamo, the amount of heat generated in the lamps or resistances is directly proportional to the number of lamps put in the circuit. Thus, with 10 lamps in the circuit, you necessarily have 10 times the heat generated in the circuit that you have with one, and so on for any number, however great or small, provided the same difference of potential be maintained at the terminals of the lamps.

Long before the date of Mr. Fontaine's experiments and Mr. Preece's mathematical demonstration of the impossibility of economically subdividing the electric light it was an accomplished fact in this country.

Careful students and inventors in this country held views entirely different from those of Mr. Fontaine and Mr. Preece—views identical with those I have already referred to in dealing with the simple principles involved in the subdivision of the light.

Mr. Brush and myself have already quite economically run arc lights in series. In my early work I looked at the matter more from the point of the simple principles previously referred to, supplemented by the further belief that if one lamp could be run on a machine and yield commercially useful results (of which there was no doubt), then there ought to be increased economy in running many lamps from a single machine, whether in multiple arc or in series, because I believed that the electrical losses could not possibly be relatively greater in a machine adapted to run several lights than in a machine adapted to run one light; and, further, because the mechanical losses should be relatively less in the former case than in the latter, and the cost of construction of a machine adapted to run a number of lights must necessarily be much smaller than the cost of several machines each adapted to run only a single light.

Encouraged by these views, the few men in this country engaged in the early developments of the art you so worthily represent to-day, worked incessantly, almost night and day, and in face of obstacles and conditions enough to discourage the most courageous, overcoming, by exertions truly herculean, the numerous and really serious difficulties met with in bringing their apparatus to a point where it was at least commercially useful. Some of them have met with substantial rewards for their earnest and arduous work, and others have lived to see outsiders reap the principal part of the harvest and garner it into storehouses in which the early workers have no share.

But to return to the incandescent lamp, which was the subject of the paper open for discussion.

I am certain that it was not the conviction of the impossibility of subdividing the electric light that restrained its development at a much earlier date. For one, I can say, in perfect truthfulness, that I saw less serious difficulties in subdividing the incandescent light than in subdividing the arc light. But there was the staggering fact of the inefficiency of the incandescent lamp as compared with the arc lamp. From the one it was only possible to obtain a small fraction of the light per unit of power expended that it was possible to obtain from the other; and as you know, that difficulty has never been overcome.

I hope I have made clear the fundamental principle that the energy required to raise a definite mass of matter up to a certain temperature and degree of luminosity, and to continuously maintain it at that temperature and degree of luminosity, is fixed and determined for that kind of matter, and is always the same for a given set of conditions. Furthermore, I hope I have also made it clear that if such a definite mass of matter emits a light, say, equal to 100 candles, and it is desired to divide it into a series of small lights of 10 candle-power each, it is only necessary to suitably divide the mass into 10 equal parts, and to expend one-tenth of the energy on each part to get the number of lights each of the desired candle power. Of course, in electric lighting there are some conditions that must be complied with in order to obtain this result in the most economical manner. Thus the mass of matter should not be so short and thick as to cause serious dissipation of heat by the conductors which carry the current to the mass to be heated to incandescence by the current. Moreover, the mass, or masses of matter should be protected from the cooling effects of the air as far as possible by being enclosed in an exhausted globe. If there ever has been any mystery about the subject of the subdivision of the electric light, it is involved in these fundamental principles. But I believe there never has been any mystery in regard to the subject at any period of the history of the art.

Following the line of thought in the minds of those denying the possiblity of the economical subdivision of the electric light, there was another body of writers who pronounced it impossible to distribute the energy without such an enormous waste or enormous cost for conductors as would render the investment wholly improfitable. This, in my opinion, was the most just objection urged to any extensive system of distribution.

The next claim was that there was no system of conductors which would meet the requirements and avoid enormous loss by escape before reaching the lamps. This objection was just as illusory as the objections to the possibility of subdividing the light.

Still another objection was that the light

would be so costly as to prohibit its competing with gas. And here let me say that the people engaged in the development of the business were guilty of the worst form of bad faith, on account of the outrageously absurd statements made by them concerning the cost of the light, and the still more outrageous statements of the amount of power required to produce them.

Some quite well known scientific men expressed opinions in a very public manner, nearly equally preposterous in the other direction, and claimed that there was no possibility of the light ever competing with gas, because it would be too expensive. Now, if we were always guided solely by the question of expense, we should not make much progress in the world. Expense, if not too great, is but a small factor in our modern life.

There are very many expensive things which we could readily dispense with, yet we use them. In general, if one thing is better or more convenient than another, people can be found in sufficient abundance to buy it, and sooner or later the general public willingly pay more for something better than anything they previously used.

The practical working out of the details of the lamps, fixtures, etc., and the distribution of the energy was, undoubtedly, one involving a great amount of work; but a fairly educated man or boy ought to have been able to understand the underlying principles and perceive the possibility of it all being done without violating any of the known and well understood laws of nature.

It is undoubtedly true that many of the difficulties in the way, as pointed out by many scientific men, were of a very serious character, and, unfortunately, some of those difficulties still exist.

Passing over the objections urged against electric lighting, and a hasty glance at the principles involved, we will now deal with a matter which I have no doubt will interest you more, as business men and station managers, namely: What is the best lamp, that is, the most efficient and most durable lamp?

It might as well be understood at once that efficiency and durability are, so to speak, antagonistic to each other with a given kind of carbon. That is to say, with a given kind of carbon and equal skill in making the lamps, as the efficiency of the lamps is increased, the durability, or lifetime, of the lamps is necessarily decreased. But, as you know, there is a great difference in this respect between lamps made by the various companies. I am aware that many have claimed that the very noticeable difference in the durability of the various lamps is solely due to the difference in their efficiency. But this is not invariably the case. For some lamps which are just as efficient as others, with which they may be compared, are also much more durable.

As a matter of fact, there are a number of things that affect the efficiency and durability of lamps. Much depends upon the care and skill displayed in making lamps; but supposing equal care and skill be employed in making lamps, there will always exist great difference in the efficiency and durability of lamps, due solely to the physical characteristics of the material out of which the carbons are made, and in some instances, to the treatment to which the carbons are subjected either before or after they are put in the lamps.

The material from which the carbons used in the modern incandescent lamp are almost invariably made is that substance known to chemists as *cellulose*. This is a general term employed to cover a series of substances of substantially the same chemical composition, and which forms the principle part of most trees and plants. It covers woods generally, such as cane, bamboo, and other woods, woody fibre and fibres of plants generally, cotton, linen and similar substances, and materials made from them, such as paper, thread, etc.

In a few cases a substance somewhat resembling cellulose is employed, namely, silk.

Mr. Townley, in his paper read before this Association, divided the lamps in use into three classes, based on certain characteristics of the carbons. While it is undoubtedly true that all lamps at present in use differ, practically, only in regard to the physical characteristics of the carbon used (setting aside the question of care and skill exercised in making them) or the slight difference in size and form of the loop; yet the classification by Mr. Townley is too restricted to do justice to the subject, because on the physical characteristics of the base from which the carbon is made, the practical value of the lamp will largely depend.

In most of the very early forms of incandescent lamps the carbons were made from substantially the same material as the arc light carbons, with which you are so familiar; that is, from powdered coke, or powdered gas retort carbon, mixed into a paste with some cementing substance like sugar, tar or pitch, which served to bind the particles of pulverized carbon together into a pasty mass, capable of being worked into the desired form. The cementing material is, during the operation of baking, decomposed, the volatile constituents escaping and leaving behind some carbon, which bound the particles of gas retort carbon or coke into a porous but strong mass.

On examining such a carbon under the microscope you will find that it has a fine, granular structure, the size of the cemented particles being dependent on the fineness of division of the original powdered carbon.

It is generally supposed that such carbon is unsuitable for use as the slender carbons of incandescent lamps. This is an error. If properly prepared, it is very good; indeed, much better than two of the carbons used by Mr. Edison in some of his first lamps. It is also quite flexible and quite strong when made as thin as carbons now generally used.

I would suggest the following classification as being more useful than that proposed by Mr. Townley:

1. Carbons made from cellulose, the physical characteristics of which has been modified by some process of manufacture which has, more or less, broken up the fibres or rearranged them and bound them together mechanically. Under this head I would include paper, cotton or linen thread or braid, and, as being closely allied, I would also include silk thread or braid.

All such bodies have the fibres more or less broken up and interlaced in a more or less irregular fashion, but are not cemented together with cementing material, such as binds woody fibres together in their natural condition.

Thus the fibres of paper are not parallel, but lie criss-cross in every direction, like the fibres of wool in a felt hat, and the points of contact are uncertain and very irregular.

The fibres of cotton, linen or silk thread, are longer, yet are not parallel, but are twisted in several strands, without any cementing or binding material to unite the strands firmly.

2. Carbons made from the previously named manufactured products, but which have been subsequently subjected to some chemical process, such as parchmentization, to cement, more or less perfectly, the separate fibres, and thus form a more or less perfect mechanical and chemical union between the interlaced fibres.

3. Carbons made from wood by simply splitting the wood in a direction as nearly coincident with the direction of the fibres as possible.

4. Carbons made from either of the above, but, for reasons which I shall presently mention, exposed to the flashing process of hydrocarbon treatment.

5. Carbons made from a perfectly homogeneous base, about which I shall have more to say later.

To those engaged in the manufacture of lamps, it is well known that the structure of the carbon resulting from the use of any one of these primary bases, or substances, out of which the loop is first cut, is precisely the same as the original base.

Thus, if paper be used as the primary base, every fibre and every defect existing in the paper will exist as perfectly after carbonization as before. Examination under a high power lens will disclose the criss-cross, interlaced arrangement of the fibres, and the fibres will be as perfect in form and arrangement as they were in the paper. The same is true of carbon made from any other material. That is to say, the carbons preserve with absolute fidelity the arrangement, structure and shape of the substances of which they are made. It follows, therefore, that every defect existing in the material of which the carbon is made, no matter how great or how small, exists also in the carbon.

You, as electrical men, will readily understand that any defective contact in any part of an electrical circuit causes the appearance of much more heat at that spot than would appear if the defective contacts did not exist. You also know that if some section of a conductor carrying a current be thinner than it ought to be, much more heat appears at that section than would be the case if the conductor was of the proper cross-section throughout. None of you would think for a moment of taking a lot of thin copper wire, cutting it into short lengths and simply interlacing them together and use them as the bus bars of main conductors for your circuits. You know well enough that such an arrangement would cause you much trouble by defective contacts, and possibly result in fusion or burning off of the mains.

Now, an untreated carbon, made from paper, is substantially such a main, and, of course, it is very defective. Defective, first, because the fibres are not firmly bound together; and, secondly, because the paper not being of uniform thickness, nor of uniform density, the carbon is also not of uniform thickness nor uniform density. Put such a carbon into an electric lamp, put the lamp in a circuit where you can control the strength of the current, turn on a *very* feeble current at first; if no part of the carbon begins to glow, increase the strength of the current very gradually, and you will notice that some part or parts of the carbon begins to glow before the remainder shows any visible signs of heat. Increase the strength of the current again, and you will generally find that some part or parts of the carbon are vividly incandescent before the other parts are above a dull red.

Now, what is true of the carbons made from paper, is more or less true of carbons made from cotton thread, linen thread and silk thread.

The average life of such carbons would probably not exceed 150 hours; somewhat more in the case of thick carbons, and much less in the case of thin ones. With such carbons I question whether the incandescent light would be in existence as a practical art to-day.

And here I hope you will pardon me if I say a few words in regard to my early work on the incandescent lamp. I met with these very difficulties in trying to secure uniform carbons very early in my work on the incandescent lamp. And these difficulties appeared in a very exaggerated form, in the kind of carbon I first attempted to use, and with the means then at my disposal to secure them thin and long enough to meet my needs. To overcome these, and some other difficulties I shall refer to later on, set me thinking. I was very familiar with the process of gas manufacture, and had known for years of that bugbear of the gas engineer, namely, the deposition of solid carbon on the inside of gas retorts, resulting from the decomposition of the vaporous and gaseous hydrocarbons evolved during the destructive distillation of the coal. I was also aware of the fact that the deposit of solid carbon formed very irregularly inside the retort, and seemed to be greatest where the temperature of the retort was highest. The thought occurred to me that if I placed my defective carbons in a carbon bearing liquid, vapor or gas, and then passed sufficient current through the carbon to at first raise the temperature of the defective spot to a red heat, the carbon would be deposited on the spots of highest electrical resistance and build them up, thus making the very agency potent in the destruction of the carbon serve the purpose of building up and obliterating the defective spots. It worked, and in a short time I brought the hydrocarbon treatment to a degree of perfection which left little more to be done. From my experiments I also found that it was very difficult to secure two or more carbons of anywhere near the same electrical resistance. I clearly foresaw, that to get uniform lights, it was necessary to do just as the gas engineer does. You know that if one gas burner has a larger slit than another, the one with the larger slit will permit the passage of more gas than the other, so that if a gas engineer wants to secure lights of the same degree of illuminating power, he makes the slits in the burners all of one size. If he wants a larger light he makes the slit larger, if a smaller light he makes the slit smaller. So with the electrician, if he wants uniform lights, he must have practically the same amount of matter in each lamp, and the resistance of the carbon must be substantially the same. With the hydrocarbon process this was easily accomplished by making the carbons all slightly smaller in cross section than was actually needed, and then depositing carbon on them in the manner described until the defective spots were all built up, and, continuing the process a little longer, it was quite easy to make the carbons all of substantially the same electrical resistance, so that, with a given electromotive force, substantially the same current would pass through all when placed in multiple arc; or, if placed in series, they would all have substantially the same electrical resistance, and, therefore, all require substantially the same expenditure of energy to bring them to the same degree of illumination.

Some of you may remember that Messrs. Sawyer & Man were the first to patent this process of treatment, and it was not until sometime after the issue of their patent that I filed my application for a patent for the same invention. The case was bitterly and stubbornly fought before every tribunal in the patent office, but was invariably decided in my favor. Sometime after the issue of the patent, the United States Electric Lighting Company brought suit against the Edison Company for infringement of my patent. No effort was made to push the case on either side for several years, and not until long after I severed my connection with the United States Electric Lighting Company. Then the United States Electric Lighting Company suddenly decided that the patent was a very valuable one, and decided to push the case vigorously. They applied to me for assistance, which, for just reasons, was refused, and they went to argument with a case essentially weak in every point where it could easily have been made conclusive, for an abundance of irrefutable proof existed of all my early work in this direction.

Your worthy vice-president read a paper on the morals of the corporations. I can truly say that I honestly endeavored to discover the existence of any moral quality in some electric light companies and failed to find any. In this particular matter, the course of both parties to the case would bring a blush of shame in the face of an honest man.

So much for that class of carbons covered by the first division.

I will now refer to the characteristics of the second class. In this class some of the defects, due to imperfect contact of the adjacent fibres, are overcome by reason of the fact that the parchmentizing process converts the outer layers of the fibres into a glutinous mass, which unites the fibres to form a more or less solid body of cellulose. But this parchmentization of the outer surface of the fibres does not wholly destroy the fibrous character of the mass, nor does it make the cross section uniform throughout the length of the loop. It follows, therefore, that carbons made from this class of bodies are still very imperfect, and exhibit in use some of the serious defects of the carbons of the first class. Hydrocarbon treatment is nearly as essential with these carbons, to secure satisfactory results, as with carbons of the first class, and that because of the existence of defective spots, as well as the necessity of equalizing the resistance of the carbons. The parchmentization process appears to yield better results with thread loops than with loops made from paper.

We have now come to that class of carbons made from substances I have placed under the third head. They are referred to by Mr. Townley as untreated or natural burners. They are only natural in the sense that they are prepared from a substance found in nature, such as wood, bamboo, cane and other similar substances, the fibres of which are more or less parallel and continuous and bound together by the natural cementing substance between the fibres. The principal objection to these substances as the base for making carbons for incandescent lamps arises from the fact that it is almost impossible to get two samples of wood having the same density, and the great difficulty of splitting the wood into thin long lengths in planes parallel to the fibres.

Mr. Edison showed excellent judgment in selecting bamboo as the base from which to make carbons for his lamps. For of all the woods available it is probably the best for the purpose. Its fibres are very straight, it is quite close grained and splits admirably. Notwithstanding these advantages, it is not by any means perfect, and there has been much complaint regarding lamps made from it. Most of the lamps under proper test show defective spots in the loops, and few of them die as good lamps ought to. That is to say, they do not gradually die all over, so to speak, but fail at some particular spot which was initially weak.

Moreover, the variation in electrical resistance of the carbons obtained from loops of the same cross section and length is very great even when great care is taken, and unless the carbons are submitted to some subsequent process after the first baking, it is practically impossible to obtain even moderately uniform results. It is not to be expected that it is possible to find a natural product like wood have a uniform density, or even approximate it. Consider for a moment the conditions of growth of plants. Are they not similar in many respects to human beings—products, to a large extent, of their surroundings? Is it reasonable to suppose that any two trees growing either close together or a long distance apart shall have the same properties exactly? I think not. In other words, there must of necessity be a considerable difference in the properties of the wood, due to climatic and other conditions, as well as those differences which are known to exist in the strength and character of the wood taken from the same tree.

Carbons of the fourth class include carbons made from any of the other three classes already referred to, but subsequently subjected to the hydrocarbon process.

There is no doubt about the general correctness of Mr. Townley's views concerning the advantages of treated carbons over untreated carbons. I am quite sure of the absolute necessity of treating carbons of the first class and possibly of the second class, in order to get commercially useful results. I am also quite sure that carbons of the third class, straight fiber, natural fiber, or bamboo type, or whatever you may choose to call them, are generally improved by the hydrocarbon treatment, properly applied.

I believe enough has been already said on the effect of the physical characteristics of the base on the resulting carbon and its influence in determining the lifetime and efficiency of lamps to make it clear that what is really required to secure the perfect lamp is an absolutely homogeneous carbon. With an absolutely homogeneous carbon of uniform cross section from end to end of the loop, the loop will not suddenly fail at a single point, long before the principal part has suffered sensible injury by use. Such a carbon will gradually die, so to speak, all over. It cannot fail at some sharply defined spots, because there is no defective spot to

be raised to a higher temperature than the other parts of the carbon. Such a carbon, even if subjected to the most searching tests, will exhibit an absolutely uniform degree of incandescence from end to end of the loop, owing to the non-existence of defective spots. This kind of carbon may be raised to a much higher temperature than ordinary carbons, and so be much higher in efficiency, and still give a much greater average life than any other carbon I know of. To obtain such a carbon it is necessary, of course, to secure a base having also a perfectly homogeneous structure. I secured such a base many years ago in several ways, but after securing the base it took several years of work to overcome the difficulties encountered in making carbons from it. But the difficulties were all overcome, and the result amply repaid me for the labor and time expended. The best way of securing the base is fully described in United States patent No. 264,987, and dated September 26, 1882.

The characteristics of the carbon and its advantages are set forth in another patent, issued to me on September 26, 1882, No. 264,986. Within the past year I have made many improvements in the method of making these carbons.

Such a carbon requires no treatment to make it better adapted for use in an incandescent lamp. If properly made, it most perfectly fulfills all the requirements of the art as it exists to-day. It makes the most efficient and durable lamp known—the thing you want. It is cheap. It exists, and yet you cannot get it. Why? Turn to the people who have been conducting the manufacturing branch of this business and ask them that question. Do you think you will get a satisfactory answer? In the struggle for the control of this whole business—and it has been bitter, and is still a bitter one—the general interest of you, gentlemen, as station managers, and the broad interest of the art as a whole, have been largely overlooked. Yes, even the best interests of the manufacturing companies have also been overlooked. I am of the opinion that if the manufacturing companies had turned their attention from the suicidal effort to annihilate each other, and had devoted to other ends some portion of the enormous sums expended in various ways, honest and dishonest, to effect that object (of annihilation), the art, as a whole, would have profited by it, and you in particular. The condition of the incandescent lamp business is to-day a peculiar one and fraught with great interest to you as station managers. There are here to day the representatives of two of the largest companies engaged in the business, each endeavoring to gain some advantage over the other. The litigation on the incandescent lamp has pretty well terminated. It has been a bitter, and in many respects, an unjust battle on all sides. I take it that the present paper is the outcome of the existing situation. One has the old lamp to sell, the other has a new lamp to introduce. A new lamp did I say? The glass stopper lamp is not new. The iron wires are not new. The carbon is not new. The absence of the information asked for in regard to what is meant by "super-treated burner" makes me hesitate to say that that is not new. But I think it improbable that those engaged in the use and experimental investigation of the hydrocarbon process left anything to be done in the way of extra treatment in that direction.

If the lamp stands service, as Mr. Townley's paper indicates, the result is, in a measure, new.

Despite the fact of the presence of representatives of both these companies, I am sorry to have to say that I do not think that either of them are engaged in giving you the best they can give. I believe that statement is true, and I utter it in all sincerity.

Time alone will settle the question of the practical value of the lamps offered.

I shall not attempt to deal with the formula presented concerning the durability and efficiency of the various lamps referred to; it would take too much of your valuable time, and would probably not interest you, but I will say that, with the facts before you, you will be able to perceive that it is a simple matter to make a lamp of any efficiency desired. By simply reducing the amount of carbon in the lamp, the carbon can be raised to a higher temperature, or higher degree of luminosity with the expenditure of less energy.

It is claimed that a two and a half watt lamp can be made to give a satisfactory life. I believe that it is possible with good low voltage lamps under close regulation. It has been known for many years that a good low voltage lamp will be more efficient and still as durable as a high voltage lamp.

President Lewis, of the Brooklyn City Railroad Company, has denied the rumor that his company proposed to reduce the wages of its employés. He said that if the State increases the road's taxes, the company may have to reduce wages, or, perhaps, go out of business, but he would wait and see what happened.

Queen's New Measuring Apparatus.

A few weeks since we described a horizontal magnet D'Arsonval galvanometer and Ryan electrometer, by Queen & Company, Philadelphia, and now other equally new and interesting apparatus of the same make is placed before our readers.

Fig. 1 represents a new form of cylinder bridge, in which all the objectionable features of old types have been discarded, while marked improvements have been made. It consists of a revolving cylinder of polished hard rubber, four inches in diameter and seven inches long, mounted on a frame. On this cylinder is cut a screw thread, in which the wire is wound in 50 turns. In front of the cylinder, and running its entire length, is a wheel, having its platinized surface turned "true," so as to bear against the wire in a firm, tangential contact. As the cylinder is revolved, the wheel slides along the scale, always in contact with the wire. This scale is divided into 50 parts, indicating complete turns. A wheel at the end of the cylinder is divided into 100 parts, each part being easily divided by the eye into tenths. Thus it is possible to read down to $\frac{1}{5000}$ part of the wire, or to the same fraction of an ohm. By means of two shunts placed inside of the cylinder, readings as low as .000002 ohm can be made. This makes the bridge very useful in determining temperature coefficients. The advantages of this over the straight wire form are, that readings are more easily made; the form is such that the wire cannot pull out of the end junctions, the contact is rolling and does not indent the wire, and the ends of the wire are near together, so that they are practically of same temperature.

Fig. 2 represents a special form of commutator for use in comparing resistances, and finding temperature coefficients by the

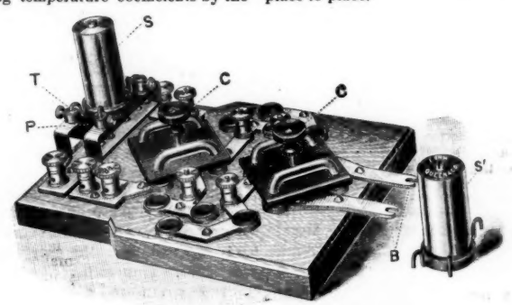


FIG. 2.—QUEEN'S SPECIAL COMMUTATOR.

Carey-Foster method. The instrument consists of an arrangement of thick copper connectors, placed on an insulating base and arranged in perfect symmetry with respect to its longer axis. The terminals for the unknown and standard resistances are arranged so that two coils in multiple can be placed on either side, a very useful feature in determining the resistance of a unit length of bridge wire. The two coils (R) and (R2) in the usual formula are wound

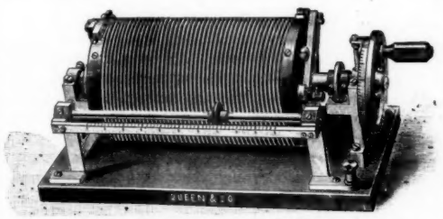


FIG. 1.—QUEEN'S CYLINDER BRIDGE.

together on a spool and enclosed in a cylindrical brass case (S) having their resistances engraved on its top. The terminals of these coils are four copper rods bent so as to accommodate themselves to the same number of mercury cups (T) mounted on a hard rubber platform (P). This arrangement facilitates changing these coils when resistances of various dimensions are to be compared. In the center of the apparatus are two groups of four mercury cups, each arranged in the form of a square. These cups are connected by two sets of connectors (C, C) passing through two hard rubber platforms provided with little handles. By suitably turning these two platforms the positions of the unknown and standard coils can be changed, as can also the direction of the battery electromotive force, making it act alternately with and against that of the thermal junction of the bridge wire and its copper terminals, and thus prevents errors arising therefrom. The instrument is placed ready for use by connecting the straps (B) across the gap of a meter bridge.

Fig. 3 is a remarkably efficient adjustable rheostat for laboratory purposes, depending for action upon the fact that the resistance of carbon is decreased by compression. The carbon used is in the form of rods placed flat, layer upon layer, in sections arranged for the purpose. A metal faced pressure block moving like a piston in each section, and operated by a wheel above, makes contact with the upper layer, while a metal sheet binds against the lower. Each section is constructed to carry from 0 to 25 amperes at an electromotive force not over five volts. The terminals of each section are brought to a switchboard by means of which the sections can be connected as desired. Using the sections in multiple the rheostat may be made to carry 150 amperes. Current up to 25 per cent. above these figures may be passed through for a short while. The regulation of the resistance which is accomplished by means of the pressure blocks is a special feature of the instrument. The resistance may be varied from 0 to 150 amperes to as close a degree of accuracy as may be detected by the current indicating instrument. The change, moreover, is gradual and not by steps, as it must always be in the ordinary form of rheostat. It is, therefore, of especial value in calibration work and for determining the characteristic curves of dynamos and motors. The whole instrument is substantially put together and can be readily carried from place to place.

Queen & Company will be pleased to mail to interested parties the handsomely illustrated supplement to their Catalogue 1-66, which contains prices and descriptions of recent specialties in standard apparatus for laboratory testing.

True Words.

It is probably true that it is not so easy for a man of limited means to make a successful start in a manufacturing business as it was 25 years ago. That is what everybody says, and hence it must be true. Still, if one notes the number of sharp, go-ahead machinists who have grown up to a business of good proportions during the past 10 or 12 years, he will almost believe that the old adage is not applicable to men of that trade. There is less chance for men who do not understand the business they try to start—let it run itself, as it were—but the live, energetic mechanic, who has capital in the way of brains to work with, the man who, in addition to mechanical skill and ability has, or acquires, good business qualities, seems just as likely to get ahead with a small capital now as ever. He will build up a business because he has something to build it on, and the determination to go on. His shop may be small at the start, but there will be all the more energy distributed over a given number of square feet. The growing up—spreading out—is only the natural result of energy confined in too narrow limits. —*American Machinist.*

Electrical Installation in the Hotel Waldorf.

The Hotel Waldorf, the latest achievement in *fin de siècle* hotel construction, is admirably situated at the northwest corner of Fifth avenue and Thirty-third street. Besides being a most highly finished and elaborate structure, as viewed from an architectural point of view, it is thoroughly equipped with the best of everything. Its furnishings are grand, not gaudy, and the admirable way in which the Edison Illuminating Company have fulfilled their part of the programme—the electrical installation—

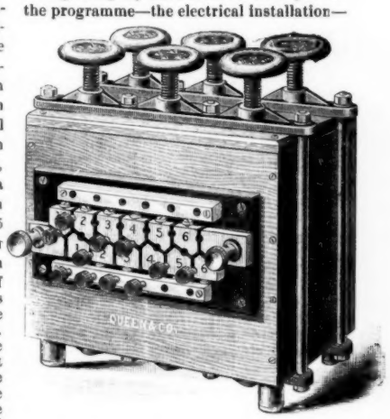


FIG. 3.—QUEEN'S LABORATORY RHEOSTAT.

speaks well for the thorough and artistic manner in which their work is done.

All of the electroliers are from Messrs. Archer & Pancoast.

Upon being told that the power plant is situated two stories below ground, one would naturally expect a miniature representation of a place that has the reputation of being rather warm. But, instead of this, try to imagine a cool, delightful, well ventilated tile covered room with all of its contents bright, new and ornamental, and you will have a little idea of what the power room of the Hotel Waldorf is like.

The electric lighting plant consists of eight 50 K. W. M. P. dynamos, built for the General Electric Company, which are connected in pairs to four 200 horse-power straight line engines. The armatures make about 200 revolutions per minute.

The whole building is wired with the three wire system, and interior conduit tubing is used throughout.

The switchboard, which is of marbleized slate, is a very handsome piece of work and is arranged for a double system of lighting. The private line is that circuit on which the lights in the private rooms are run, and the public line takes in the lights in the large halls and in the large electroliers. In all there is a capacity for 6,500 sixteen candle-power incandescent lights.

The switches are of heavy copper and are arranged in groups supplied with 100, 200, 400 and 500 ampere fuses. The latest Weston illuminated dial voltmeters and ammeters are the measuring instruments used, and all other connections around the room are on polished white marble.

Six large and six small steam pumps continue at their work, and cool air shafts make the atmosphere a pleasant one to work in.

South of the engine room and underneath the sidewalk is the boiler room supplied with the Babcock & Wilcox high pressure boilers. To the north is the ice plant containing two De La Vergne refrigerating machines, which have a capacity of about three tons of cake ice and 1,500 water bottles per diem outside of the supply for the numerous ice boxes and refrigerators situated about the hotel.

Every machine is noiseless, and although the ceiling is not high the slightest whisper can be heard in these two rooms, which contains such a number of different machines that are working away for the benefit of the occupants of this grand hotel, without a sound of complaint or dissatisfaction. All is peace and harmony.

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It is not generally known that it is illegal to paste circulars on lamp posts or telegraph poles. A bill poster in this city came to grief last week and was held for trial in the Essex Market Police Court for the violation of this law.

The inhabitants of Mexico have never been known to be guilty of imitating the progressive Americans in their desire for very rapid transit. The climate of their country does not agree with speed in any undertaking. Street cars can be hired for personal use for the moderate sum of $3.50 per day, and moreover the owners of the road rent with the car the right to stop at any one place on the line for two consecutive hours. It is to be doubted that any of the numerous bromo preparations for overwork and nervous prostration would find a large sale in that country. Possibly the introduction of the trolley might wake them up somewhat.

The recent solar disturbances have passed out of our field of vision, but they have not departed without leaving in their wake some slight reminder in the form of a magnetic storm, which has played some curious pranks with the wires of the Western Union Company. An auroral wave accompanying the culmination of these disturbances had been predicted, and several tests made on the wires last week showed that the prediction had been verified. Those wires which went to the north and south were but slightly affected, while those that extended to the east and west showed unmistakable evidence of being influenced by stray electric currents. The force developed was but slight and it is possible that the alternate layers of hot and cold air over the country might have had some additional effect. Nevertheless, these differences in temperature would not be sufficient to cause the decided results noticed. Not only were the long lines affected, but currents were observed in a short line between New York and Elizabethport, some 15 miles in length.

Now that the fundamental telephone patent has expired, telephone talk is in the air. Notwithstanding which, the directors of the Bell Telephone Company will recommend an increase in capital stock of $2,500,000 to $20,000,000, which is the authorized limit.

It has always seemed as if the using of batteries for telegraphic communication has been a little behind the age. Their maintenance was quite a bother to the office attendants, who in many cases have wondered why their use was continued. Now the Western Union Company have discarded the batteries on their quadruplex wires, and are now running them from a dynamo current. The advantage of this is immediately apparent when it is learned that there are about 25 quadruplex wires in use.

With the introduction of arc lights in the South have come numerous bugs of more or less dangerous species. One in particular that is worthy of notice has been termed the electric light bug. It is about an inch and a half long and from a sixteenth to a quarter in thickness, and seems to consist wholly of legs and wings. They have hitherto been considered harmless, but now it is believed that they bite or sting, with direful results. Recently a gentleman in the South attempted to remove one from the corner of a sofa in his house, where it had taken refuge, and was very much surprised to find that it produced a stinging sensation in his hand, which rapidly spread to his arms and head. The pain increased during the night, and he was obliged to hold his hand in an upright position to alleviate in a measure his intense suffering. The next morning he found that his hand, arm, and even a portion of the skin of his head, had broken out with scaly ulcers. It was only after a long and continual application of a bismuth and vaseline poultice that the ulcers healed. Look out for the electric light bug; he is abroad in the sunny South.

A WRONG TO RIGHT.

In a recent editorial, which appeared in the columns of the New York *Evening Post*, the writer argues that this State owes the Western Union Telegraph Company the sum of about $150,000 plus the interest for about 10 years, and that this sum was unjustly extorted from the company in the year 1881. This rather startling statement is given to the public in the interest of good morals solely. In the year 1880 the Legislature passed a law to tax the capital stock of corporations "doing business within this State." A suit ensued between the State and some of the companies that resisted, and as a result it was declared that there was nothing in the law restricting the tax to the capital employed within the State, hence judgment was entered against the companies, and the Comptroller was obliged to proceed against all New York companies doing business outside the State, or partly within and partly without the State. He obtained a judgment for $161,000 from the Western Union Company for 1881, this being upon the entire capital stock of the company, while on the portion of its capital stock employed within the State the tax would have been but $12,500. Notwithstanding this, the company paid taxes on all of its property in every other State and Territory in the Union. Had all the other States taxed the company it would have made the injustice of the tax obvious, for the sum would have amounted to $7,610,868. Immediately after this a bill was passed, restricting the corporation tax to the portion of capital employed within the State, but it applied only to subsequent years. The claim now of the Western Union Company against the State is for the difference between $161,000 and $12,500 and interest. It would seem that the justice of this claim should be apparent to a right-minded man, and the question which may be raised, Is there enough money in the State Treasury to pay all the companies thus taxed? may be entirely put aside when it is known that there is quite a fair sized surplus waiting to be distributed in the cause of common justice.

LETTERS FROM A LABORATORY.—XXXVII.

BY JULIAN A. MOSES.

Not long ago one of the workers in my laboratory attempted to and did pick up a soldering iron which had but recently been in the soldering furnace. The way in which he dropped it and the consequences that ensued are thoroughly familiar to any one who has ever been in a similar position. If a person should be asked what he did when he picked it up, he would probably say: He dropped it immediately. Should this answer be given it would be, in a measure, correct, but the statement would be theoretically false, for there is a period which elapses between the moment of the actual contact between the flesh and the piece of hot metal and the moment that the fingers release their grasp and allow it to drop. This period may seem short and inappreciable, but in reality a definite time does elapse between these two moments. The sensation must first be communicated to one set of nerves, which in turn telegraph it to the brain and from there, after being appreciated and properly classified, under the head of pain, a return set of nerves recommunicate it to the hand and the hand is forcibly withdrawn from the object. All this takes time and, as a matter of fact, several scientists have tried to find the speed of the transmission of nerve sensation and have determined it more or less exactly, *i. e.*, each experimenter has had in his results a large number of figures in his decimal. But no two of them have agreed. This may possibly be due to their respective personal equations, which are in no two cases exactly alike, or their methods may have been at fault. However, there can be no way of proving the correctness of the results, and as the matter is not of much practical importance, no great amount of research has been expended upon it.

A rather novel way of determining it, approximately, by electrical means, was discovered by me and may be described as follows:

One evening, while using a Holtz machine in the dark, for the purpose of examining into the instantaneousness of the spark and its effect on the eyes, I happened to notice my right hand, which was holding the handle attached to the driving wheel. Of course, each time that the spark passed the hand seemed to be resting perfectly still, but it was in reality moving around with the wheel. Spark after spark passed until I began to realize that my hand did not appear to be in the position in which it was felt to be. This continued some time, until distinct spots could be located as the positions of the hand at the moment of the passage of the spark. It was always noticed that the hand was felt quite a number of degrees, generally 100 or 120, behind the spot in which it was seen when the wheel was being turned at about 120 revolutions per minute. This phenomenon would go to show that since the appreciation of the position, as seen, is practically instantaneous, due to the fact that the optic nerves are in such close proximity to the brain, and that no return sensation is required, that the sensation of feeling had reached the brain a definite time after the impression had been received, and this time could be easily calculated.

Say, for instance, that at the moment of the passage of the spark the hand was *felt* at the highest point of the driving wheel, and that it was *seen* at the lowest point, it would, therefore, follow that the time of transmission of the sensation of the location was that during which the wheel made one-half a revolution. When the distance was about 180°, it was found that the wheel was making about 180 revolutions per minute. Taking it for granted, now, that the visual appreciation is practically instantaneous, the time of one-half a revolution, which would be in the neighborhood of one-sixth or one-seventh of a second, would represent the time that the nerves were transmitting the impression of touch or location to the brain.

It was found that this time varied with different individuals, but the average speed of transmission of this nervous impulse was about 20 feet per second from the hand to the arm and from thence to the brain. By having a warm or hot handle the transmission seemed to be hastened, but in so slight a degree that no certainty could be attached to the fact whether heat impressions travel quicker than impressions of touch or location.

CORRESPONDENCE.

OUR BOSTON LETTER.

The Directors of the electric light company of Springfield, Mass., are discussing the feasibility of erecting a power station at Indian Orchard to utilize the water power at that place for the operation of their plant. Plans have already been submitted for a brick structure costing about $125,000, and it is probable the negotiations for the purchase of the site will soon be consummated.

Boston Electrical Circles have suffered another loss recently in the sudden death from pneumonia on Saturday, March 11, of Mr. D. A. Andrews, Sr., who was the head and front of the large supply house of the Pettingell-Andrews Company. Mr. Andrews has always been actively engaged in mercantile pursuits, and has filled the office of treasurer and financial manager of his company since its incorporation. His executive ability was of the highest order, and it is mainly to his untiring efforts that the concern owes its present high standing and enviable reputation. He was in all respects a genial, whole-souled gentleman, and we learn of his sudden death with unfeigned regret.

A Heated Controversy is now being carried on before the city government of Fall River, Mass., between the Globe Street Railway Company and the Fall River and New Bedford Street Railway Company, a new corporation whose petition for a charter is now before the legislature. The Globe Company desire to extend their system to the town line of Westport, and need less than a foot more of franchise to give them the desired location. They are being strenuously opposed by the new company, who want to compete for the local business. After a long argument, it was finally decided to continue the hearing until April 4, pending the result of the fight before the legislature.

It is with mixed feelings of regret and congratulation, regret for our own sake and congratulation for him, that we learn of the permanent departure from electrical circles, in this city, of Dr. F. A. C. Perrine, the well-known and genial treasurer of the Germania Electric Company. Dr. Perrine has received, within the past week, an appointment to the professorship of electrical engineering in the Leland Stanford, Junior, University, of California, and will start for the scene of his future labors on June 1. Dr. Perrine, while a young man in years, is well-known in both the commercial and scientific circles of the industry. He is a graduate of Princeton College, and hastaken three degrees in that institution—A. B., D. Sc. and A. M. In Boston, especially, he leaves a host of friends to regret his departure, who, at the same time, heartily congratulate him on his appointment, which, in view of recent occurrences, is particularly acceptable at this time. He will spend the month of June at his home, on the Wemrock Farm, in Freehold, N. J., and from there will go to Chicago, where he will pass a month or six weeks in the study of electrical exhibits at the World's Fair. The Leland Stanford University is located at Palo Alto, Santa Clara county, Cal., and is one of the finest institutions of the country. The natural beauties of the situation, the climate and surroundings are unsurpassed, and Dr. Perrine may well feel that, in the privilege afforded him of pursuing his favorite vocation under such circumstances, his lines have, indeed, fallen in pleasant places.

There is a marked feeling of relief among electrical men and others whose offices are located in the Hathaway Building, at No. 620 Atlantic avenue, over the final discovery and arrest of the young firebug who for some time past has made this building the scene of his operations, and whose desire to "see a big blaze" has imperiled so many lives and so much valuable property. The investigation into the origin of the many fires started, which fortunately were discovered in time to prevent serious damage, has been carried on quietly for the past month, and on March 16 were brought to a head by the arrest of Louis A. Wright, a 17 year old office boy in the employ of W. R. Fleming & Company, whose office is situated on the ground floor. When first charged with the crime he protested his innocence, but finally broke down and confessed his guilt, after which he was taken to headquarters and locked up. His last attempt at incendiarism was made on the evening of March 10, while the big fire was raging in Lincoln street, only a few blocks distant, and at which the entire fire department of the city and suburbs was engaged. Like the previous fires, it was discovered through the vigilance of the janitor and put out before doing any serious damage, but the results which might have been accomplished by this young fiend, especially under the circumstances prevailing at the time, cannot readily be imagined. This is not the first time he has been in trouble, and the 600 occupants of the building whose lives have been endangered are relieved to know that he is now placed where he will not be able to exercise his peculiar talents for some time to come. H. G. T.

Boston, March 18.

OUR CHICAGO LETTER.

Cutler & Hammer have fitted up their shop at 313 South Canal street, Chicago, and are prepared to repair and recalibrate all kinds of measuring instruments.

Mr. J. W. Godfrey, of the New York Insulated Wire Company, is in Chicago looking after the interests of his company in connection with World's Fair contracts.

Mr. Frank S. De Ronde, general sales agent of the Standard Paint Company, who has been in Chicago for the past week, visited this office on Tuesday of this week. Mr. De Ronde returned to New York on Wednesday.

Geo. Cutter, of Chicago, is mailing to his customers and friends a very handsome catalogue of his electric specialties. The book is of convenient size and very handsomely gotten up, and will prove very serviceable to every buyer.

Mr. H. W. Hill, of the Hill Clutch Works, Cleveland, O., is in Chicago attending to a very handsome contract which his company has received for the MacKaye Spectatorium plant, which is being erected near the Fair Grounds. M. J. B.

Chicago, March 18.

Death of Samuel Boardman.

PRESIDENT OF THE BISHOP GUTTA-PERCHA COMPANY.

Mr. Samuel Boardman, president of the Bishop Gutta-Percha Company, and senior member of the law firm of Boardman & Boardman, 155–157 Broadway, New York, died at his residence, at Newark, N. J., on Tuesday, March 14. Mr. Boardman was born in Manchester, England, in 1816. He came to New York in 1832, and studied medicine here, but soon after being admitted was appointed surgeon at the United States arsenal, Chattahoochee, Fla. Florida was at that time a Territory, and General Taylor was stationed there and was prosecuting the Seminole War.

A few years later Mr. Boardman was appointed commandant of the arsenal, with the rank of captain. He remained in that position for several years, filling the offices of surgeon and commander of the arsenal and postmaster of the station, but on account of failing health he decided to return to New York.

He studied law for two or three years before resigning his post at Chattahoochee, and in 1853 came to New York, entering the office of Benedict & Boardman, which firm he soon joined as partner. The late Charles O'Connor was a member of the same firm.

Mr. Samuel Boardman in his younger days was a prominent Mason, reaching the position of Deputy Grand Master of the Grand Lodge in Florida. One of his first clients in New York was Samuel C. Bishop, the proprietor of the Bishop Gutta Percha Works, who was also an enthusiastic Mason. Mr. Boardman was attorney for Mr. Bishop until the death of the latter, which occurred in 1872, and afterwards for Mrs. Bishop, in whose name the Gutta Percha Works were conducted until her death in 1881. Mr. Boardman continued the business until 1885, when he organized the present Bishop Gutta Percha Company, of which he remained president until his death. He was for many years a member of the Manhattan Club and of the Bar Association of this city.

Dr. Herz Expelled from the National Electric Light Association.

At a session of the executive committee of the National Electric Light Association held at St. Louis last week, the name of Dr. Cornelius Herz, of Panama scandal notoriety, was expunged from the roll of honorary members.

Incandescent Lamp News from Boston.

The final act of the incandescent lamp drama, at least so far as the Eastern circuit is concerned, was brought to a close on the morning of March 17, in the United States Circuit Court at Boston.

The closing scene partook somewhat of the nature of the event for which this day is celebrated in the history of the city, and though the feeling of enthusiasm which marked the earlier event was entirely lacking, it was, nevertheless, an "evacuation" in every sense of the word.

The legal struggle has run its course. That it has been of intense interest to all is well known, and that the element of tragedy was not lacking was shown in the closing scene, when the last two opponents summoned to appear gave up the struggle as utterly hopeless, and decided to accept the inevitable defeat which they felt was awaiting them.

The companies in question were the Germania Electric Company and the Boston Incandescent Lamp Company, and, as neither put in any defence, a permanent injunction was granted against each. The former company, by far the largest and strongest of the two, anticipated events by several days, and on March 15 made an assignment to Attorney Charles A. Williams, of Boston, and will dispose of their plant and stock, if possible, and go out of business entirely.

What action the Boston Incandescent Lamp Company will take is not yet known, but the probabilities are that a similar course is the only one open to them.

The only remaining lamp manufacturer now doing business in the East is the Bernstein Electric Company. There are peculiar circumstances in connection with this company which leave the course of the General Electric Company in relation to it a matter of speculation, and opinions on this subject are very much divided.

It seems to be the general belief, however, that the West will be the next battle ground, and that the fight will be pushed as strongly there as it has been in the East, with probably the same result.

An idea of the sentiment which is beginning to prevail among lamp manufacturers may be gathered from the tone of the following letter, which has been sent to the trade by the Germania Electric Company. It sizes up the situation in very few words:

We regret to say that the Edison patent on the incandescent lamp has been sustained by so many different courts as against all the defences that are known to us, that we recognize our inability to continue the manufacture of incandescent lamps. Suit has been brought against us, in which suit we will undoubtedly be enjoined by the court from so doing.

We, therefore, propose to go out of the business of manufacturing lamps, and shall be unable to take or fill orders for incandescent lamps from and after this date, except in so far as by arrangement with the General Electric Company we may be authorized to dispose of the small stock of lamps which we have on hand. If you desire any of these few lamps, we would suggest that, until our stock is exhausted, you ask the General Electric Company to allow us to supply them to you, as it is apparent to us that it is only through that company you will henceforth be able to secure lamps.

We are endeavoring to make an arrangement with the General Electric Company by which you may deal directly with us for these lamps, in which case we will notify you. Yours very truly,

THE GERMANIA ELECTRIC CO.

This is certainly pitiful, plaintive and positive.

PERSONAL.

Mr. W. H. McKinlock, of Chicago, president of the Central Electric Company, and Mrs. McKinlock and Mrs. M. J. Greene are guests of the Hotel Imperial, New York.

Mr. Paul T. Kenney, who formerly represented the Mather Electric Company in New York, has severed his connection with that concern, and is not connected with the parent company or any of its branch offices.

Mr. C. O. Baker, Jr., the well known platinum manufacturer, sailed for Europe on the "Majestic," Wednesday of this week. Mr. Baker goes to Europe on business, and will be away from New York for several weeks.

All the fire alarm wires now strung on poles in New York city are to be placed underground. The Board of Fire Commissioners will receive bids for the work until 10 o'clock A.M. on Wednesday, March 29.

ADVANCE ELECTRICAL NEWS FROM EUROPE.

AUSTRIAN ELECTRIC RAILWAYS.

The Viennese have for some years advocated the establishment of a metropolitan railway, and although various proposals have been made in this direction, no material steps have been taken to accomplish the object in view. It is, however, expected, now that electric railways are projected in Vienna, that the government will be induced to consent to the building on one system or another of the long talked of metropolitan line. In this connection it is worthy of note that the Anglo-Austrian Bank, in conjunction with Messrs. Siemens & Halske and the General Austrian Electricity Company, has approached the municipality with a detailed scheme for the construction of an electric railway to encircle the inner town, and a branch line to pass through the inner part of the town. The ring line would commence at the Praterstern and terminate at the crossing of the Schwarzspanier street, by the Währing street, although it would eventually be extended to the Danube Canal. Specially interesting is the fact that, if a concession is granted for these lines, they would be laid down on the slotted conduit system, which has yielded good working results at Buda-Pesth. Siemens & Halske are to be the contractors and the current is to be provided by the General Austrian Electricity Company, which has just completed its second large central station in the Leopoldstadt district. Another scheme, however, concerning Buda-Pesth, for an underground electric railway in that city, has been abandoned by the promoters, Messrs. Siemens & Halske, who have succeeded in making a common agreement with the tramway company, and according to which a portion of the latter's lines would be worked on the trolley system. The European continent is very fruitful in electric railway schemes, which will probably at no distant date be practically put into execution.

ELECTRICAL LEGISLATION IN GERMANY.

In recent years complaints have been made in Germany that the details of bills proposing to legislate on questions of considerable importance to the country at large have been kept secret until the moment they are introduced into the Imperial Diet, and that if their passing is hastened, as often happens, those directly concerned find it impossible to express their opinions and impart their technical knowledge on the subjects at issue. This is detrimental in many cases to the industries concerned, and this policy seems to amount to the government not receiving (with the exception of from its own officials) expert opinion from the trades interested. This policy was not pursued a few years ago, as for instance in the case of the Patent Act, but it is now very largely followed. The German electric light and power bill, to which reference was made on a previous occasion, is embodied in the present policy. After slumbering on the table of a committee of the Federal Council for a year and a half, the bill has been rushed through the Federal Council and is, it seems, to be similarly treated in the Imperial Diet, before which it has just been laid. The electric light and power bill was proposed a few years ago simultaneously with the then telegraph bill, and although the latter was passed with undue haste, it has never satisfied either the government or the trades of the country. The former, postponed at the time, is as an act to be so framed as to meet the deficiencies of the telegraph act. The electric light bill as set forth is said to be neither necessary nor useful, and the concensus of opinion of the speakers, including many well known German electrical engineers, at a meeting last month of the Berlin Society of Engineers was to that effect. It is, moreover, contended that the bill, if it becomes law, will seriously hamper the electrical industries. There is reason to suppose that the bill, which really contains many unnecessary regulations, and which is now before the Upper House, will be passed, notwithstanding the protests of a large section of the electrical trades of the country.

London, March 4. A. W.

Our Patent System.

BY ARTHUR STEUART, OF THE AMERICAN ASSOCIATION OF INVENTORS.

I shall ask your attention to a few suggestions of the distinctions between the patent system of the United States and those of other countries, but I shall not attempt to review before you the multitudinous and minute distinctions between the various systems, but content myself with a discussion of some of the fundamental principles involved.

At the outset, therefore, of our discussion, let us consider the subject matter with reference to which all patent laws are enacted.

It will be conceded that the creator of a thought has an inherent right by natural law to the ownership of his idea so long as it remains within his own breast, unuttered or communicated to others. That an idea, therefore, is property; intellectual property; and it is to the philosophy of the natural rights which a man possesses in his intellectual property that I shall ask your attention.

What is intellectual property; and what are the rights which its possessor has to private and exclusive ownership therein? The subject is one in which this association is most deeply interested. The establishment of this class of property upon a firm and lasting basis, and one which is surrounded with all the legal recognition and remedies which are accorded to other classes of property, is, as I understand it, the chief aim of this association.

Mr. N. S. Shaler, in a classic article on this subject, published in 1878, says:

"The man who brings out of nothingness some child of thoughts has rights therein which cannot belong to any other sort of property. Land or chattels are pre-existing in some form, and the rights therein are limited in many ways, and are held in the great service of the world, but the inventor of a book or other contrivance of thought, holds his property, as a god holds it, by right of creation; with his silence or inaction the sustenance and advance of millions yet to be may vanish into the darkness again. His brain has brought the seed out of the infinite, planted it in good soil, tended it with the care that only the sower can feel. . . . . It will be clearly seen that intellectual property is, after all, the only absolute possession in the world."

The clear conception and legal protection of intellectual property is the nicest refinement of the law of property, and the most logical and equitable recognition of the rights of man to the exclusive enjoyment of that which owes its origin to his individual efforts. But this recognition is a matter of comparatively recent years.

In early times, when might made right, and when the strongest took by force what he wanted, the conception of property in an idea was unknown, and it was not until comparatively recent times that the legal recognition was given to the rights of authors and inventors.

Drone on Copyright says (page 1):

For half a century after the Act of Anne was passed (1710, 8 Anne C/19), the Chancery Courts, in administering the law, did not doubt that by the common law and independently of legislation there was property of unlimited duration in printed books. In 1769 this principle was affirmed by the Court of King's Bench. (Miller *vs.* Taylor, 4 Burr. 2303.)

The right to exclusive ownership in an invention after it had been made known to the public, and without the grant of a patent, was not known to the common law of England, but it has always seemed to me that this was more a matter of accident than of any logical difference between a book and an invention in the mechanic arts, or of any intention on the part of the formers of the English common law to recognize or establish any essential difference between literary property and invention.

The history of English monopolies is familiar to all of you, and it will be recalled that at the time when the first patents were granted by the English Crown, about 1600, or rather when the first effort was made by legal methods to protect the exclusive property in an invention, the people were smarting under the odious monopolies of the necessities of life, which were prevalent and had been practiced for more than a century prior to that time.

To attempt, therefore, to monopolize an article like a new and peculiar form of playing cards (Darcy *vs.* Allen, Noy Rep. 173 (1602)), although brought forth by an original inventor or first introducer into the realm, without an express grant from the Crown, would at once arouse all the prejudices and animosities of both people and the courts, against the effort to assert the rights of private ownership in an idea which all citizens, without recognizing the distinction between a new idea and an old one, considered that they had an equal right to employ at their pleasure.

In view, therefore, of this strong, although unreasoning, feeling among both people and judges, and of the further fact that the Crown was only too ready to grant almost any monopoly for which it could extract a fee, the practice of granting monopoly patents in England grew up even before there was any statute requiring or providing for them.

The first statute expressly providing for the grant of patents in England was the great statute of monopolies of 1623, 21 James II, Ch. 3; but prior to this time many patents for inventions had been granted, not because they were necessary, but because the inventors felt that, in the existing state of feeling with reference to monopolies, it would not be safe to trust their property in the hands of the public without a monopoly grant from the Crown.

This prejudice did not exist with reference to books, and although there is no logical difference between an original idea as expressed in a book and an original idea of a way to perform a useful art, or construct and operate a machine, the courts did not hesitate at the earliest time to sustain the natural and common law right of an author to his writings. It seems, therefore, clear that but for the existing evil of monopolies, and the violent and natural prejudice against them which existed at the time when it first became necessary to protect the property of the inventor in his invention, that the natural right of an inventor to the exclusive ownership of his intellectual property would have been recognized, and if it had been recognized, I believe the patent systems of England and the other nations of Europe would have been very different from what they have been during the past two hundred years, and from what they are to-day.

It has been argued by some learned and astute writers on patent law that a monopoly grant is essential to the protection of exclusive property in an invention, for the reason that, as soon as an invention is made public, it becomes at once a part of the store of public knowledge and the natural and lawful possession of all mankind, and that to restrict or curtail this right requires an act of the sovereign.

This argument seems to me strained, for the reason that it presupposes that all men, as soon as they become possessed of an idea, have an inherent right to use it without restraint for their own benefit. If this be true it would apply with equal force to a book or poem or other composition of an author, but we have shown that the courts of England, both before and after the Statute of Anne, recognized an author's exclusive rights in his published works by natural right of creation. If, therefore, we admit as a fundamental proposition that an inventor has an inherent and natural right to his new inventions after publication without a patent, we have arrived, in my opinion, at the most salient and important distinction between the patent systems of Europe and the United States.

It is probably a fact that the prevalence of odious monopolies throughout Europe during the sixteenth and seventeenth centuries led to the firm establishment in the minds of the jurists of Europe of the idea that a patent for an invention did not differ materially from an odious monopoly, and must be treated as such, and the rules of law established under this feeling prevail, in spite of many changes and improvements, to the present day.

The usual conditions of the grant of a monopoly of the odious kind was that its terms and limitations were strictly specified, and in the interpretation of these grants the greatest strictness was adhered to by the courts for the purpose of defeating them if possible. The object of the grant of the monopoly being to raise revenue for the Crown, an annual tax was always imposed, which was the heaviest that the grant would stand in each case. For many years this was the rule applied to patents for invention, and in some important particulars is still the rule.

While the courts of England and other European countries have become very liberal in construing letters patent, and have shown great latitude and indulgence to inventors in their efforts to secure to them the real fruits of their inventions, still the high and annual tax is retained, and, except in Germany, where the American system has been almost exactly copied, no effort is made to determine the validity of the grant before the issue.

It is true that the courts of the United States have never recognized in express terms any inherent rights in inventions apart from statute. This is due to the fact that a constitutional provision and statute, expressly providing for the methods of securing this class of intellectual property to its creator, were enacted before the courts were called upon to act upon any case of this kind. But the language of the Constitution and the statutes enacted in pursuance thereof all manifest an entirely different conception of the nature and rights of this class of property from those entertained by the Europeans.

The patent acts of England are justified by the judges on the ground of the supposed benefit which the public will derive after the patent has expired. But the Constitution of the United States, recognizing the inherent property in the inventor, provides that "Congress shall pass laws to secure to authors and inventors for limited times the exclusive right to their writings and discoveries."

The statutes enacted in pursuance of this section deal entirely with the procedure by which the property of the inventor may be fully and firmly secured to him. The fees required are small, only enough to cover the cost of the necessary examination. No taxes are charged, and the patent, when granted, is *prima facie* evidence of its own validity. The existence of these statutes in no way negatives the inherent rights of the inventor in his intellectual property.

The primary condition of the acquisition of property in an idea is the fact of creation. A system of patent law, therefore, which rests upon a recognition of this condition must provide for some method of determining this fact before the evidence of title is given to a claimant.

To determine this fact, when claim is made to property in an invention, it is necessary that a clear and explicit definition of the thing claimed should be made by the inventor and filed with the duly appointed agent of the Government, upon whom devolves the duty of *examining* the state of the art and determining the question of patentability. If the idea embodied is found to be new, it is adjudged to be the property of the inventor, and he is granted exclusive rights in the same for a limited time.

The question at once arises, if the property is absolute, why should there be any limitation upon the duration of the title? Why should it not be perpetual, as that of any other kind of property? The answer to this question is, that ideas differ essentially from all other classes of property; they are so far-reaching in their nature and influence that each new idea given to the world at once becomes in the minds of men the seed of many other ideas which in themselves are the property of their creators, but if they are dependent for their application upon the use of the first fundamental idea, they are controlled by it and its owner. It, therefore, becomes a question of public policy how long the title of the first inventor shall be allowed to control the property of the second and third and fourth inventor, in the creation of whose property the first inventor took no part, and to which he has no title.

The jurists of the world have with common consent fixed this term at from 10 to 20 years, with provision in some cases for extension.

It, therefore, appears that the fundamental distinction between the patent systems of the United States and those of almost all the other countries of the world lies in the fact that in this country intellectual property is impliedly recognized as the inherent property of its creator, and all the provisions of law are framed for the purpose of enforcing this idea, securing this property to its creator, and offering the highest possible stimulus to the people of the land to improve the conditions under which they live and work, by assuring them of a firm and consistent protection for every item of knowledge which they may add to the world's store.

The Europeans, on the contrary, while they are liberal in their treatment of the inventor in the courts, tax him to death while he holds his patent; and, with the exception of Germany, before referred to, surround his patent with none of the sanctity and presumptions which give it a market value when issued, and offer an inducement to investors and manufacturers to take an interest in it.

The taxation of patents, or rather of intellectual property, seems to me to be most illogical. It may be said that patents are personal property, and should be taxed as other personal property, but it will be readily seen that an attempt to do this will at once lead to injustice and hardship. How are you to separate the idea from its embodiment? As soon as an idea is embodied in tangible form, the thing is at once taxed at its assessed value, which is the result of the materials contained in it, and the idea upon which they are put together. The idea, as a rule, gives a large part of the value to the manufactured article, and just to the extent to which this is true, the idea is taxed, and just so often as the idea is embodied in a manufactured article, the idea is taxed. The Europeans contend that a tax should be laid upon the patent, because it represents rights and remedies. I reply, are rights and remedies taxable? Are not the right to life, liberty and the pursuit of happiness and enjoyment of private property, rights which no tax law has ever attempted to reach? The right to think cannot be taxed. The right to the ownership of one's thoughts cannot be taxed. The thoughts themselves, when embodied in corporal things, become taxable property, and are taxed in regular course as all property, but the ideas, and the right to the exclusive use of the ideas, cannot logically be the subject of taxation, because the value of the abstract idea cannot be assessed by any satisfactory method, and it is palpably unjust to tax all patents alike; some are of great value, some of none.

EFFECT UPON THE MINDS OF A PEOPLE OF A SYSTEM OF MONOPOLIES AS DISTINGUISHED FROM A RECOGNITION OF INTELLECTUAL PROPERTY.

Wherein lies the wealth of a nation or an age? I do not think I shall meet with any denial when I assert that the wealth of a nation or age lies in its intellectual attainment—not the intellectual attainment of a few of its great men, but the general intellectual attainment of the nation as a whole.

The promotion of the intelligence of a people has in all ages been the aim of the wisest legislators. Various methods of accomplishing this result have been resorted to. The foundation of colleges and universities, and the establishment of systems of public education have been of untold value, but the most potent and far-reaching legislation ever adopted by any nation for the promotion of intellectual growth among its

people has been the legislation for the protection of intellectual property in the United States.

Recurring to the pamphlet of Mr. Shaler, he says, page 54:

"Few inventions of value can be put into the complicated framework of a society without years of devoted toil and vast sums of money. Take a new invention that will revolutionize trade; grant then, that when introduced it will save, say, five million days labor each year to this country. It will then have to overcome the inertia of a vast machinery and the opposition of a great population who are momentarily troubled by it. Experience shows that it will require from ten thousand to half a million dollars to give this seed a chance to take root and show its nature. Where are the philanthropists who will give their time and money to this work if their pay is to be made in fine words?

"Men are never willing to make roads for others to travel; it has been found that men build railways for the pure enterprise of the thing, and it is ridiculous to talk of manufacturers building costly ways to new methods when others could traverse them without cost."

Page 67:

"Everyone familiar with the history of inventions is aware that important economic inventions of every description have been opposed by the prejudice of men in the most vigorous fashion. It is, perhaps, the strongest argument for the economy of patents, that nothing but the prospect of large pecuniary rewards would give us men to undergo the martyrdom which awaits the man who would overcome these barriers of prejudice. The same sort of obstacle awaits the invention when it comes to be carried into a new community. At each stage there is a struggle for existence with the previous possessors of the field, and nothing but a money prize can be devised to secure the overcoming of the barriers of doubt, dread and indolence that stand against it."

These expressions of one of the foremost thinkers of our time are worthy of our most careful consideration.

The patent system, which offers to the inventor the greatest security and the highest commercial value in his property, is the best system and the one which will produce the most beneficial effects upon the largest number of citizens.

The patent legislation of the United States recognizes the true nature of the property to be protected, puts the cost to the inventor at the lowest possible figure, imposes no taxes, permits no forfeitures for any cause during the term, and provides an examination into novelty before issue, which raises so strong a presumption of validity for every patent that it becomes a piece of saleable property as soon as issued, or it may be held during the whole of its term without deterioration or danger of forfeiture. This system of law throws around intellectual property the highest security, and gives to it the greatest possible money value, hence offers the highest stimulus to intellectual development and effort among our people.

The European laws on the other hand differ essentially from ours in many of these particulars. The fees and taxes are very high and of annual recurrency, and must be paid on pain of forfeiture of the monopoly. Except in Germany, no examination is made, so that a manufacturer has no assurance of the validity of a patent offered to him for purchase or use, and the patent as property in the hands of the inventor has no financial stability. It is, therefore, a thing of little value after its grant. This cause operates to increase the difficulty of getting the invention introduced and put into practical service, and, unless it is put into practical service within a limited time, from one to two years in most countries, the grant is forfeited.

It is easy, therefore, to compare the effect of the two systems upon the minds of the citizens of the respective countries in which they prevail.

In the one case everything is done to give value and protection to the property of the inventor, while in the other, it seems as if the remnant of the law of monopolies which has been retained serves to deprive intellectual property of the industrial kind of almost all of its value, and to remove almost entirely the incentive which patent laws should give to the citizens of a nation to mental effort and improvement of the conditions of daily life and work.

MISCONCEPTION OF THE NATURE OF INTELLECTUAL PROPERTY BY SOME OF THE JUDGES OF LATER TIMES.

The provisions of law which require the inventor to describe accurately his invention in his application, so that the public may be in full possession of all he knows upon the subject, as well as that the government shall require a claim of most rigid limitation appended to a patent to define its scope, and prevent injustice to other owners of ideas relating to the same subject, are most just and salutory in their nature, but I cannot see either logic or justice in the rulings of some of the courts in recent times, to the effect that everything described, but not specifically claimed in a patent, shall be considered as abandoned to the public. This rule seems to me to be out of harmony with the principle that all legislation on the subject of patents has for its object to secure to inventors for limited periods the exclusive right to their inventions, and to savor very strongly of the old rule of construing odious monopolies, which was that they must always be construed most favorably to the public and most unfavorably to the grantee. This rule has been applied very rigidly in the construction of public franchises granted by State or municipal governments to corporations. The franchise is held to be a right or property possessed by the community at large until a monopoly of it is granted to a private individual or corporation. In such a case the rule is justly applied, but in the case of intellectual property—the creation of a human mind, a new thing added to the store of the world's knowledge, the rule is altogether out of place.

An invention is not a right taken from the public and put within the exclusive control of an individual, and, therefore, should not be treated in any such harsh way, but on the contrary, the tenderest consideration should be shown to an inventor, and the utmost liberality resorted to by the courts to secure to him the full measure of protection for all that it can be shown he has added to the knowledge of the world. If for any reason it should happen that the claim of a patent when drawn by a solicitor and allowed by the Patent Office (as is so often the case), is unnecessarily limited in scope, and this fact should appear at the trial of a case for infringement, I think it should be the duty of the Court to correct the patent by construction and to give it the scope to which it is clearly shown by the evidence the inventor is entitled. Such a rule, I submit, would be much more in harmony with the spirit of the Constitution and the theory of the whole patent law, than the one which now prevails.

I do not believe that such a rule would be abused. The Patent Office would continue its work as now, and it would very seldom happen that the courts would be willing to give a patent a broader construction than the Patent Office have done in formulating the claim; but should the ends of justice require it, I submit the Court ought to have the power to broaden the patent, and ought not to hesitate to exercise it.

The prevalence of such a rule would greatly strengthen the stability of property in inventions, and just to the extent to which it did this it would increase the prizes offered for intellectual attainment, and the stimulus to intellectual effort on the part of the people.

How Electricity Travels in St. Joe.

"Electricity doesn't travel in the center of a wire," was the remark I heard City Electrician Yenawine make not long since. "Although to hear people talk one would think this was the case. The electrical force is really conveyed through the insulation or other surroundings of the wire and passes in parallels around it. Copper is more freely used, because the atmospheric conditions surrounding that metal are more favorable than those surrounding iron. It is necessary to understand the influence of rain and the part it actually plays in the conveying of electricity from place to place, to understand the experiments that are now taking place for telegraphing and telephoning without wires at all."—*St. Joseph, Mo., News.*

Proud of Their Own Electricity.

(*London Lightning.*)

Electricity in America has a way of exhibiting eccentricities and vagaries that are quite as startling as anything Professor Oliver Lodge's "bucking" lightning can accomplish. A Baltimore "story" relates how a small electric light wire fell across the roof of a house in a snowstorm, and charged two iron-fronted buildings and the piece of *pavement in front of them*, until "big balls of fire and blue streams of sparks" began leaping across from the windows, and every one who passed without india rubber shoes on fell down in screaming fits. How happy we should be that English electricity is more civilized than the American brand.

The Bristol Lamps and Batteries.

Some time ago the London General Omnibus Company decided to try the experiment of introducing electric lamps into the leading routes of omnibuses owned by them, and, after negotiations, entered into an arrangement with the Bristol Electric Safety Lamp Works to supply 140 omnibuses with small incandescent lamps worked by their patent battery, according to the *London Electrician*. Fig. 1 shows lamp and battery and contact plates, and Fig. 2 shows the interior of an omnibus and the position of the battery and lamp with connections.

The battery selected for this service

FIG. 1.—BRISTOL LAMP AND BATTERY.

weighs about eight pounds, and is placed, as shown in a wooden box, under one of the seats. The box is provided with two brass spring terminals, which make automatic contact with the battery when it is let down into the box. The lamp is of a special design, and is made as shallow as possible, to allow of its being placed in the center of the roof, it being found that this arrangement distributes the light most satisfactorily all over the carriage. The lamp is covered by Mr. L. Bristol's patents, and offers great advantages for omnibus work, since breakage of filaments from the shaking of the carriages is avoided. Ordinary bottom loop lamps are used, and two wire hooks, which expand sideways, clasp these loops firmly. A wire spring, which catches the top of the incandescent lamp, forces it against the wire hooks and increases the clutch of the hooks.

The batteries are charged at Victoria,

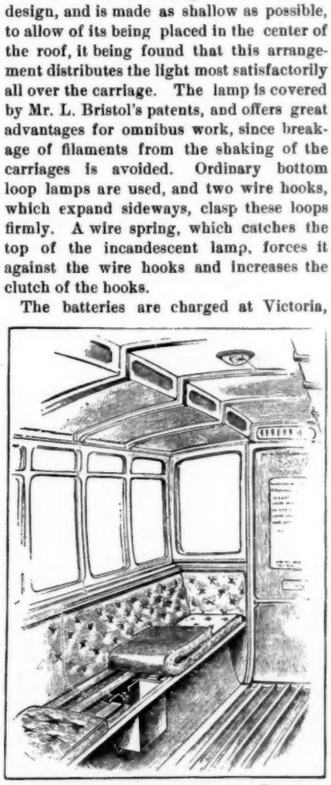

FIG. 2.—INTERIOR OF OMNIBUS LIGHTED WITH BRISTOL LAMPS.

seven in series, from the Westminster Electric Supply Corporation's mains, small incandescent lamps being used as resistances. The batteries have, we understand, stood the test in a very satisfactory way, and the severe shaking to which they are necessarily subjected while in use has had no effect upon the plates.

The installation has been very successful, the only difficulty experienced being to get time to charge the batteries for the whole night's run, as the lamps are delivered between the hours of 9 and 12 A. M., and the serving out commences about half past two, but a sufficient number of spare batteries now provided will overcome this difficulty.

Fig. 3 shows a type of lamp and battery which is used by the ticket inspectors in the employ of the London General Omnibus Company, and consists of a pocket accumulator and a button-hole lamp. This lamp has been in use for the past year, and has given satisfaction.

Electricity in Flat Life.

The longer I live in a flat the firmer believer I will be in the predicted great future of electricity. A flat occupied by a dozen families and constantly heated up to a summer heat by steam is simply one vast reservoir of electricity. Walk across the carpeted room of any flat, and many houses for that matter, then touch a metallic substance and there will forthwith come a snap at the point of contact and a very decided shock up your arm.

It is startling to the novice.

Whenever I have the energy—and it does not require very much to walk through my flat—I go on a snapping tour and get shocks enough to bring the blush to any fiend of rheumatism or paralysis that may be lurking near.

It saves matches, however.

I found that out by an accident. I wanted to light the gas. Turning it on and touching a finger to the burner, there was a snap and then a blaze.

But it burned my finger.

The children have lots of fun through this easy way of generating electricity. Of course, children are always moving quickly and dragging their shoes over the carpets. In consequence they are always charged and have no end of amusement in making "the snap come" on some one else.

It is a little embarrassing nevertheless

FIG. 3.—TICKET INSPECTOR'S LAMP.

to meet a young lady and as you shake hands with her get shocked, if only up to your elbow. A friend of mind at a reception the other day had such an experience and dropped a rosebud's hand so suddenly that she was offended and wouldn't speak to him again, much to his disgust.—*New York Herald.*

LITERARY.

"Journal of the Institution of Electrical Engineers for March, 1893," has been received.

The *North American Review* for March contains a number of important articles upon subjects that are engaging public attention at the present moment.

"Tales from *Town Topics*, No. 7," the March number, has made its appearance, containing, in addition to its usual collection of stories, sketches, poems, etc., a very interesting prize novelette, 80 pages in length, entitled "The Cousin of the King."

We have received the following: "Proceedings of the Electrical Section of the Franklin Institute," vol. 2, 1892. "Journal of the United States Artillery," for January, 1893. "Annual report of the Light-House Board to the Secretary of the Treasury for the Fiscal Year Ended June 30, 1892." "Journal of The Institution of Electrical Engineers" for February, 1893. A well compiled telephone directory for February, 1893, issued by the Pacific Telephone and Telegraph Company.

Black Diamonds.

M. Moissan has produced crystallized black carbon by heating graphitic iron in an arc produced by 450 amperes. On cooling, the black diamonds are said to crystallize out. The crucible employed was made of quicklime, with a groove for the carbons to rest in. The temperature is said to have been 3,000 degrees C.—*London Industries.*

Will the Closed Conduit Supersede the Trolley in Large Cities?

READ BEFORE THE BUFFALO ELECTRICAL SOCIETY, BY FRANK C. PERKINS, MARCH 6, 1892.

It would be folly for any one to assert that the trolley system for operating electric railways will be thrown out of use in small cities, villages and rural districts; and until some efficient, practical and reliable closed conduit system is brought before the public, the trolley will still continue to be used in the large cities as well.

A conduit system, however simple, could not compete with the trolley in the country, where long lines are necessary, and where

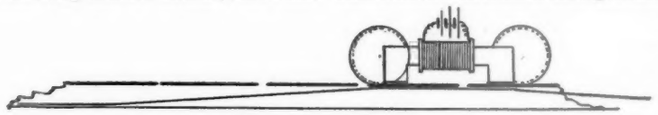

FIG. 1.—LINEFF SYSTEM.

wooden poles and a comparatively cheap line construction gives good satisfaction to the railway company and is not seriously objected to by the public.

In large cities, however, where the trolley system is so greatly objected to on account of the so called "unsightly overhead wires," the conduit system, when perfected, will find many advocates and will be readily adopted by street railway companies interested. After looking at a street crossing in Boston, with its network of wires as used in the trolley system, and then noticing the entire absence of overhead conductors in the city of Buda-Pesth, Hungary, one is impressed with the advantages of the conduit system, as well as the great difficulties under which our firemen have to work.

Regarding the cost of construction, a conduit system would compare very favorably with the trolley in cities where the authorities insist on the feeder wires being placed in underground conduits, and where an expensive line construction, with iron poles, guard wires, etc., is required.

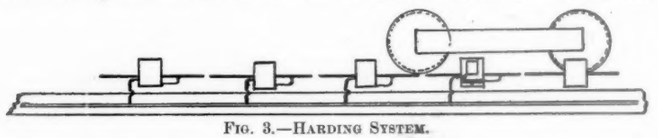

FIG. 3.—HARDING SYSTEM.

The systems now in use for operating electric railways are, first, the trolley, and second, the open slot conduit. Every one is so familiar with the trolley system, that to go into details regarding its operation would be a waste of time; but we are not so familiar with the open slot conduit, as it is not in general use at present.

The Siemens & Halske system has been in use for some time in Buda-Pesth, Hungary, the Love system is now in operation

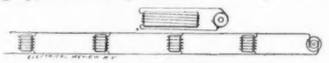

FIG. 5.—DEWEY SYSTEM.

in Chicago, and the Bentley-Knight system was operated a short time in Boston, but has not been in use for several years.

The greatest difficulty the companies using the open slot conduits have to contend with is maintaining a good insulation for the main conductors, the loss of current through leakage in wet weather being sometimes very great.

Many methods have been proposed whereby closed conduits might be used, thus avoiding the misuse of the conduit for a sewer, as is often the case with open conduits.

The closed conduit system is the one we wish to discuss this evening. Many patents have been granted in this line of work, and

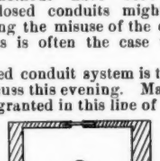

FIG. 6.—VAN DEPOELE SYSTEM.

it will be interesting to study some of them.

The conduits may be divided into two groups. 1. Those operated electrically, such as the Lineff, Smith, Harding, Heron, Dewey and others. 2. Those operated mechanically, such as those of Van Depoele, Thomson, Brain and others.

The objects of the closed conduit are to do away with slotted channels and to shut in the conductor so that neither dirt nor water can reach it and form a source of leakage.

An English patent was granted Alexander Lineff, of London, July 11, 1888. The characteristic feature of his invention is that a magnet on the car, as it travels, keeps attracting or drawing up fresh portions of an iron band, and thus puts the conductor proper in electrical connection with one or two sections of an upper rail, from which the current can be collected by a trolley wheel, in the usual manner, for driving the car. In case the connection is broken, a battery must be kept on the car to energize the magnet, in order to again pick up the iron band or conductor within the conduit.

Mr. H. W. Smith, of Newark, N. J., was granted United States patents March 5, 1889, for a system using a closed sectional conduit, in which the connection was made from the main bare conductor inside the conduit to the surface sections by means of small armatures mounted on bearings within the conduit. These armatures were attracted and drawn up by permanent and electro magnets mounted on the frame of the car. The permanent magnets were, undoubtedly, used to avoid carrying storage batteries on the car, in case the connections were broken between the main conductor and the sections of the conduit. The current is conveyed to the car by means of brushes.

Mr. Chas. Harding, of Atlantic, Iowa, was granted English patents, April 15, 1891, for a sectional closed conduit system, in which each section of the conduit was connected to the main conductor within automatically as the car passed, by means of electro-magnetic switches or contact devices placed in sealed boxes, one for each section.

Mr. Wm. B. Heron, of Brooklyn, was granted American patents, August 18, 1891. His plan is to use a magnet on the car, and a "traveling armature" on wheels within the sectional conduit. As the car moves along, the traveling armature is attracted or drawn along by the magnet on the car.

It is not stated how the traveling armature is picked up again, should it wander away from the car.

An American patent was issued to Mr. Mark W. Dewey recently, on an induction system, using alternating currents, the arrangement of the transformers being such that the primary circuit is underneath the roadbed, while the secondary is carried upon the car, so that there is no metallic connection between the car and the main circuit from which the current is derived.

Mr. Dewey's plan is to place the primary coils wound upon U-shaped iron cores in the roadbed between the rails at equal distances apart and at intervals corresponding to the length of the car. The apparatus carried on the car constitutes the other half of the transformer. Each motor has an inverted U-shaped or straight iron core, upon which one or more secondary coils are wound. When a good alternating current motor is placed on the market, this system will undoubtedly receive greater attention than it has heretofore.

Mr. C. J. Van Depoele has invented a system which works mechanically and is in reality an open slot conduit with a rubber or other flexible guard, which is pressed open as the plow moves along and closes the conduit after the car has passed.

Mr. Elihu Thomson invented a similar closed conduit, using a brush or broom as a guard, instead of rubber, to close the slot.

February 7, 1893, the writer was granted a United States patent for a closed conduit system for electric railways, consisting of a bare conductor mounted on an insulating support in a conduit, the top of which is rendered elastic by being formed of sheet metal adapted to be pressed into contact with the supply conductor by a motor car.

Fig. 7, A, the metallic tube formed of copper, brass, steel, phosphor-bronze, or any suitable material having the requisite elasticity and being proof against the effects of the weather, and at the same time a good conductor of electricity. This tube is jointed in lengths, somewhat as stove pipes are placed together, insulating joints being used; and this tube contains an insulated support B within it, which may be of wood impregnated with oil, or otherwise treated to render it a good insulator, upon which is mounted a bare supply conductor C. The tubular shell may be circular in cross section, but is preferably provided with a number of corrugations so as to give it increased flexibility.

This tube is enclosed in an exterior slotted conduit, which may be made of terra cotta or other suitable material. Where high potentials are used for the supply current, the space between the metallic envelope and the supports for the conductor may be filled with oil. In fact, should alternating currents be used, the two primary conductors of high potential may be carried within the conduit and transformed to low potential at intervals by means of transformers, one terminal of the secondary of which could be connected to conductor C, within the conduit, and the other to the ground.

In its normal position the tube is maintained by its own elasticity out of contact with the conductor C, and may be held at any suitable distance therefrom, which will, of course, vary with the size of the conduit, increased flexibility being possible as the size of the tube increases.

Upon the car is mounted a presser foot, shod with a wheel at the point where it enters the conduit and comes in contact with the metallic tube, which may be arranged so that the degree of pressure may be controlled by the motorman. The pressure of the wheel can be varied as desired, but must be sufficient to force the top of the metallic tube A into contact with the conductor C.

Under these circumstances, as the car proceeds along the line of way, a shifting contact is maintained by the wheel between the tube A and the conductor C, and the current is, therefore, led from the conductor to the motor on the car by suitable connections, the tube A raising away from the conductor C as the car passes any given point.

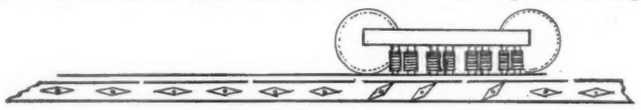

FIG. 2.—SMITH SYSTEM.

It may be well to consider the surface leakage from sectional conduit systems, operating, say, 50 cars. The only data obtainable at once are from experiments made by Mr. Gisbert Kapp, author of "Electrical Transmission of Energy." In a paper read by him before the British Association, September, 1890, in reference to the loss from leakage of sections of the Lineff system, he says: To ascertain the surface leakage I applied the voltmeter test, and found the following insulation resistances of three charged sections of the magnetic rail of the closed conduit. With the line clear and moist, 4,183 ohms; with the line very wet and covered with mud and water, 980 ohms.

Taking 2,000 ohms as an average, the loss of power at 300 volts by surface leakage per car amounts to 45 watts.

FIG. 4.—HERON SYSTEM.

Taking Mr. Kapp's figures for a basis of calculation, for 50 cars the surface leakage would be 2,250 watts, or about three horse-power.

Now, as the potential universally used here is 500 volts, the loss by surface leakage for three sections would be 125 watts per car, or 6,250 watts for 50 cars. This would amount to about eight horse-power.

It is, therefore, safe to conclude, if Mr. Kapp's data and experiments are correct,

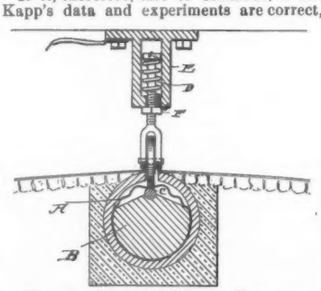

FIG. 7.—PERKINS' CLOSED CONDUIT SYSTEM.

that the surface leakage would not be serious in the sectional conduit systems.

The following are the requirements in order that a closed conduit system may compare favorably with the trolley:

1. Simplicity. 2. Efficiency. 3. Reliability. 4. Small number of working parts. 5. Low cost of construction.

Do any of the above proposed methods satisfy these conditions?

GENERAL NOTES.

This week the electric buoys are working for the first time in the Sound off Weir, Mass., since the entire harbor has been closed by ice.

The franchise given recently to the Tonawanda Electric Railroad Company to lay tracks for their proposed road in the town was rescinded by the village trustees at their last meeting. The failure on the part of the company to comply with the conditions under which the franchise was granted caused the action of the trustees.

The annual meeting of the General Electric Company was held on March 10, at No. 44 Broad street. The former trustees were re-elected, as follows: C. A. Coffin, Charles H. Coster, Thomas A. Edison, S. D. Greene, J. Hobart Herrick, Edward H. Johnson, Arnold Marcus, Carl Schurz, Francis S. Smithers, Samuel Spencer, J. Hood Wright.

The Detroit, Lansing and Northern Railroad is the heaviest loser by the flood in Portland, Michigan, which occurred on March 12. Saturday night 600 feet of track were washed out half a mile east of the depot by an ice gorge which turned the course of Looking Glass river across the roadbed. Several bridges are in danger and the electric light plant is entirely flooded.

A stock company is being organized in Philadelphia to manufacture an electric music leaf turner recently patented by W. J. Dailey, lately a draughtsman at Lynn, Mass. All of the large piano manufacturers are interested in the company. The invention is intended to do away with the necessity of turning the leaf by hand, as by a simple pressing of a key the sheet of music is turned over.

The annual meeting of the stockholders of the District Telegraph Company, of Boston, was held in New York on March 1. The business was merely of a routine character. Charles A. Tinker was made president for the ensuing year and R. H. Rochester was chosen as secretary and treasurer. The board of directors elected consists of F. L. Ames, A. R. Brewster, Thomas T. Eckert, W. C. Humstone, R. H. Rochester, Thomas Roche and Charles A. Tinker.

A bill was introduced in Albany, on March 8, by Senator Walker fixing telephone charges in cities of more than 500,000 at $75 a year, in cities of less than 500,000 at $50 a year, and in towns and villages of less than 10,000 at $36. Switching to any point in the State shall not be more than 10 cents for 10 miles or less, three-quarters of a cent a mile for a distance of from 10 to 50 miles, and one-half a cent for over 50 miles; non-subscribers to be charged the same rates as subscribers, with an advance of 10 per cent. The act is to take effect on July 1.

The following are a few figures regarding the relative cost of arc light service in a few cities. Strange to say, the cost of fuel is about the same; but there are other elements which enter into consideration to make these differences:

CITIES.	PER LAMP.
Utica [3 year contract]	35 cents.
Troy [5 year contract]	39½ "
Albany [1 year contract]	50 "
Elmira [1,200 candle-power]	28 "
Syracuse [5 year contract]	30 "
Buffalo	35 "
Scranton	25 "
Rome	33 "
Corning [$100 a year for dark night schedule.]	
Boston	40 "
Cleveland, O. [$88 a year for moonlight schedule.]	

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

FOSTORIA, O.—R. W. Brown, of Tiffin, O., has asked the council for the right of way through the city, for an electric railway to Bowling Green. This is an extension of the Tiffin-Fostoria line.

HACKENSACK, N. J.—The Bergen County Board of Freeholders has voted unanimously, to permit the Jersey City, Hoboken and Rutherford, and the Passaic, Rutherford, and Carlstadt Electric Railway Companies to lay tracks on the Paterson plank road, running from Passaic to a point a mile east of Carlstadt.

WAUWATOSA, WIS.—The Wauwatosa Street Railway Company, capital stock $25,000, has been incorporated by August Richter, Jr., Adolph C. Dich and Joseph P. Schubert.

PHILADELPHIA, PA.—The People's Traction Company, of Philadelphia, capital stock $5,000,000, has been incorporated by John L. Welsh, R. Nelson Buckley, Edward J. Matthews and Caleb F. Fox. The business of the company will be the construction and operation of motor and cable machinery for supplying power to passenger railways.

ST. LOUIS, MO.—Work is to be begun shortly on the Rinkelville extension of the Citizens' Railway, which is to be changed from mule to electric power and extended to the city limits.

ROYERSFORD, PA.—The Royersford and Spring City Street Railway Company; capital stock, $12,000; incorporators, C. J. Lewis, of Philadelphia, and others.

GRAND ISLAND, NEB.—The city council has passed an ordinance granting the Grand Island Street Railway Company the right to construct and operate an electric street railway and incandescent light plant.

MT. GILEAD, O.—Persons representing J. G. White & Company, electrical engineers and contractors of New York city, are on the ground investigating the feasibility of constructing an electric line from Marion through Mt. Gilead, Chesterville and Fredericktown to Mt. Vernon.

LACONIA, N. H.—The street railway company proposes to make extensive improvements by substituting electricity for animal power on its street railways.

BROOKLYN, N. Y.—The Nassau Electric Railroad Company; capital, $6,000,000. Incorporators, P. H. Flynn, Frederick C. Cocheu, James C. Brower and others. The road will be a double track line, and will be 27 miles long. The board of aldermen has been petitioned for a franchise.

PHILADELPHIA, PA.—The West Traction Company; capital, $10,000. Incorporators, John Hopkins, Thos. G. Hunter, Edward B. Smith and Eldridge E. Nock. The object of the company is to absorb the Forty-second Street, West Park, The Forty-ninth and Westminster Streets and The Philadelphia West Side Passenger Railroad Companies.

SHELTON, CONN.—Watson J. Miller and Aaron J. Smith have applied for incorporation for the Shelton Street Railway Company.

FINDLAY, O.—Application has been made for the incorporation of the Northern Ohio Electric Railway, Light and Power Company. It is proposed to connect Findlay, Fostoria and Tiffin with Lake Erie resorts by an electric line, and also furnish the towns along the route with electric light and power.

FREMONT, O.—The Fremont Street Railway Company has made application to extend its lines throughout the city and to build a complete electric system.

OWEGO, N. Y.—The village trustees have granted a franchise to the Owego Railway & Navigation Company.

NORWALK, O.—The council has passed an ordinance granting right of way through the town to the Sandusky, Milan & Norwalk Electric Railway Company.

BLOOMINGTON, ILL.—Bloomington is to be connected with the city of Lexington by an electric railway 20 miles in length. A similar road is to be built from Bloomington to Leroy, 20 miles east. United States Senator W. H. Patterson, of Mifflinton, Pa., president of the Bloomington & Normal Company, is at the head of the scheme. The line will cost fully $500,000.

WELLSTON, O.—The Wellston Belt & Street Railway Company has been incorporated with a capital stock of $12,000.

EAST ST. LOUIS, ILL.—The Columbian Electric Underground Tramway Company, capital stock $1,000,000, has been incorporated by Daniel J. Murnane, Geo. L. Beeke and S. Von Phul.

PORT HURON, MICH.—A company has been formed in this city, consisting of L. A. Sherman, James H. White, Frederick L. Wells, Henry Howe and others, for the purpose of building an electric railway from Port Huron to Marine City, a distance of 20 miles.

SPRINGFIELD, O.—An electric railway, 26 miles long, connecting Springfield and Dayton, is being discussed. An electric road is to be built from this city to the new Masonic Home. It is proposed to extend the line through Donnelsville and Medway to Dayton.

CORNING, N. Y.—The common council of Corning has granted a franchise to the Citizens' Electric Street Railway Company. The company has not yet accepted it, as the conditions are severe in some measures.

LOUISIANA, MO.—The Pike County Court, on application of Judge T. J. Fagg, attorney for the St. Louis syndicate, at present represented by Col. James O. Broadhead, of St. Louis, W. J. Dougherty and O. C. Brison, has granted a franchise for the construction of an electric railway between this city and Ashley, a distance of 18 miles.

CALAIS, ME.—Higgins Brothers, of New York City, have offered to build an electric street railway from Calais to St. Stephen, N. B., provided they be granted the right of way. A local company now holds a charter.

WORCESTER, MASS.—The selectment of Clinton have granted a franchise to the Clinton Street Railway Company, promoted by N. C. Swift, of Chicago. The company is given permission to lay 10 miles of track, on condition that its lines will be completed by November 1, and that it give the North End Street Railway and the Worcester North Street Railway right to run cars over the tracks. The North End Company proposes to extend its tracks to Clinton the coming summer, and the completion of these three roads will be an electric line from Worcester to Fitchburg.

LEBANON, PA.—The Reading and Temple Electric Railway Company has decided to construct a branch railway to Meyerstown.

WORCESTER, MASS.—The Blackstone Valley Street Railway Company, organized to build an electric road from Millbury to Rockdale, has formed a permanent organization by electing Hon. Samuel Winslow, president, and Thomas T. Robinson, treasurer. The towns along the route will at once be petitioned for franchises.

MONTREAL, CAN.—Another electric company, composed of Montreal, Toronto and New York capitalists, is contemplated to build an electric railroad in Montreal.

COLUMBUS, O. — The Columbus Central Railway Company; capital, $1,500,000. Incorporators, John J. Shipherd, Thomas Jopling, John Ehrhardt and Earnest W. Radder.

COLUMBIA, PA.—The Columbia Traction Company; capital, $10,000. Directors, Michael Reilly, Edward McGavern and John A. Coyle, of Lancaster, and Wm. D. Given, of Columbia.

JACKSONVILLE, ILL.—The Springfield, Jacksonville and Winchester Electric Railway Company; capital, $1,000,000. Incorporators, Samuel S. DeWees, of Alexander; James C. Self, George Huffaker and W. Case, of Jacksonville.

WHEELING, W. VA.—The Wheeling Street Railway Company has purchased the Bellaire Street Railway. The consideration is supposed to be about $100,000. The purchase is the first step in the scheme to establish a system of electric lines connecting Wheeling and Martin's Ferry, Bellaire and Bridgport, a circuit of 28 miles.

AN INVENTIVE AGE.

Muggthorpe lives in a lonely spot out in Seedville. This shows how he utilizes his electrical studies to find his way home when the moon refuses to shine.—*Life.*

SAN ANTONIO, TEX.—The Electric Power and Street Railway Company; capital, $300,000. Incorporators, H. E. Barnard and C. C. Cresson, of San Antonio, and Albert H. Billard, Chas. E. Harris, Wm. J. Clark and Frederick C. Dow, of New York.

Electric Light and Power.

KANSAS CITY, MO.—The Kansas City Electrical Works have asked the city council for a franchise for a plant in the south eastern part of the city.

MILWAUKEE, WIS.—The South Milwaukee Light and Power Company, to operate an electric light plant in South Milwaukee; capital stock, $15,000. Directors are Wm. W. Williams, A. W. Bell and Frank H. Brice.

COLUMBUS, TEX.—The city council has granted a franchise to Towell & Shaw, permitting them to establish and maintain a system of electric lights in Columbus.

PHILADELPHIA, PA.—The Enterprise Manufacturing Company; capital stock, $1,600,000. The company will manufacture electrical appliances and other machinery.

WINDSOR LOCKS, CONN.—The Windsor Locks Electric Lighting Company has petitioned the legislature for permission to increase its capital stock to $30,000 to enable it to increase the capacity of its plant.

ROSLYN, N. Y.—Henry Stanton has made application to the Board of Trustees of Sea Cliff for the privilege of erecting poles and stringing wires for electric light purposes.

CLAYTON, N. J.—An electric light company will be organized at Clayton, to light the streets of the borough.

AMSTERDAM, N. Y.—A bill to allow the Amsterdam Street Railway Company to supply electric light, heat and power to the city has been favorably reported in the Assembly, at Albany.

TRENTON, N. J.—The Heat, Light and Power Company, of New Jersey; capital, $300,000. Incorporators, Duncan MacKenzie, W. H. Apgar, John H. Scudder and others. The company proposes to erect gas and electric plants in various parts of the city.

GEORGETOWN, COLO. — The electric light and power company and the gas company have taken steps to consolidate. A stock company is to be formed with a capital of $35,000.

GUILFORD, CONN.—At a borough meeting it was decided to light Guilford by electricity. Plans are now under way looking toward the formation of a company.

SAN RAFAEL, CAL. — Supervisors have granted a franchise to Bartlett & Company to build an electric line at Belvedere. The current and power will be transmitted through a cable two miles in length.

EAST HARTFORD, CONN.—P. S. Bryant, J. A. Stoughton and A. P. Moore have petitioned for the incorporation of the East Hartford Light and Power Company.

CHICAGO, ILL.—The Mutual Electric Light and Power Company; capital, $75,000. Incorporators, Chas. D. Wright, Wm. A. Conover, and Alfred R. Hechman.

BUTTE, NEB.—A joint stock company has been formed for the purpose of building a flouring mill and furnishing electricity for power and lighting purposes. The incorporators are D. W. Forbes, M. H. Green, S. C. Sample, G. T. Bastedo and others.

BROWNSVILLE, ORE.—Capitalists have been in Brownsville recently, negotiating with its citizens for the establishment of an electric light plant.

LAKEFIELD, ONT.—The plant of the Lakefield Electric Light Company has been destroyed by fire. Loss, $3,000.

BRADDOCK, PA.—The Peoples' Electric Light Company has decided to again ask for right of way through the town.

BEVERLY, N. J.—The Beverly and Edgewater Park Electric Light and Power Company; capital, $30,000. Incorporators, Wm. E. Harrison, Edmund G. Harrison, John V. Rice, Jr., and George M. Lane.

New Telephone Companies.

ST. PAUL, MINN.—The Independent Telephone Company; capital stock, $10,000. Incorporators, Morgan Brooks, Walter S. Morton and James F. Elmer. The business of the company will be the construction and equipment of private lines in distinction from a public telephone exchange.

ALBANY, N. Y.—The Hudson River Telephone Company will rebuild its circuits between Kingston and Ellenville, Newburgh and Walden, Newburgh and Cornwall and Fishkill and Peekskill.

BUTTE, MONT.—The Montana Electric & Telephone Company; capital stock, $2,000,000. Incorporators, Marcus Daly, Patrick Mullins, John P. Reins, John D. Rite and F. Harrington. The objects of this corporation are to build and maintain electric light systems, a telephone system, electric railway, and manufacture and sell electrical mining and other machinery and appliances.

EAU CLAIRE, WIS.—The Eau Claire Telephone & Lighting Company has been organized. The company will put in a telephone exchange and may buy the electric light plant of the Street Railway, Light & Power Company.

KINDRED INTERESTS

The Berlin Iron Bridge Company have just completed a power station, 38 feet wide by 112 feet long, for the Roaring Fork Electric Light and Power Company, at Aspen, Colo.

George Cutter, 329 "The Rookery," Chicago, has sent out a very handsome little catalogue which does not pretend to cover the whole line of electrical supplies, but is devoted to those choice devices which have been developed as "Cutter's specialties." The illustrations are arranged so as to be quickly found.

Nantasket Steamboat Company, Boston, Mass., have purchased for their steamers four "Ball" engines, built by the Ball Engine Company, Erie, Pa., to be used as power for electric lighting. J. H. Houghton, Boston agent of the Ball Engine Company, made the sale. The Blakely & Dickson Traction Street Railway Company, Scranton, Pa., is to be supplied with power by three 300 horse-power Ball engines, built by the Ball Engine Company, Erie, Pa.

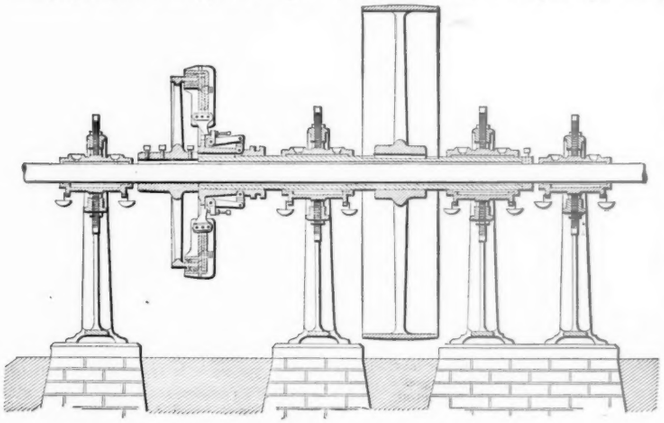

FIG. 1.—PRYIBIL'S FRICTION CLUTCH PULLEY WITH QUILL.

Improved Power Transmission Devices.

When friction pulleys run loose on a shaft they consume power, wear loose in the hub, and require great care to keep properly oiled. The arrangement shown in Fig. 1, it is claimed, has none of these faults. It consists of a quill encircling the shaft and carrying the pulley and the friction clutch. This quill does not touch the shaft, but is carried by independent, self-oiling, adjustable bearings. This device is especially recommended for dynamos, and for other machinery which has to remain at rest part of the time while the shaft revolves. When used for such, they entirely relieve all running bearings from the belt strain when the machine is at rest.

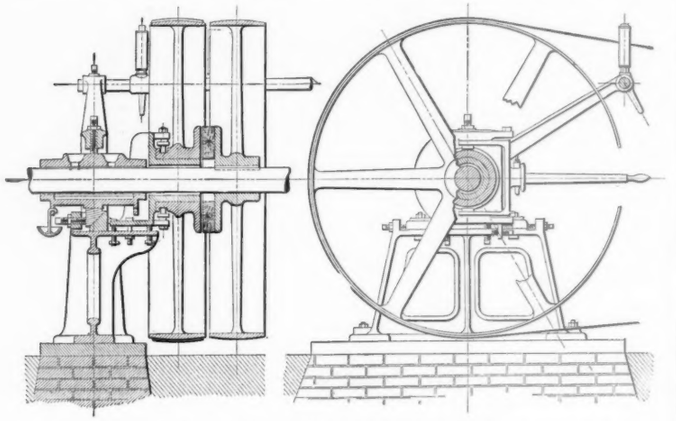

FIG. 2.—PRYIBIL'S LOOSE PULLEY STAND.

Fig. 2 shows a loose pulley stand as arranged for driving dynamos. It is also applicable to saw mills or to other machinery which stands at rest part of the time, while the shaft remains in motion. When either a plain friction pulley or an ordinary loose pulley is used for this purpose, the hub wears loose on the shaft, power is consumed and constant care required to keep properly oiled and prevent heating and cutting.

With the arrangement shown, the loose pulley remains at rest on a fixed bracket, except while the belt is being shifted either on or off. The loose pulley, therefore, requires hardly any attention, and the shaft is entirely relieved from belt strain, when it ceases to drive the machine. To get the belt in motion so as to shift it off of the loose pulley, the latter is forced over by a hand lever into contact with a friction disc attached to the fast pulley on the shaft. As soon as the belt is on the fast pulley the loose pulley is again allowed to come to rest.

P. Pryibil, 554–556 West Forty-first street, New York city, manufactures these devices.

NEWS NOTES.

The Philadelphia General Electric Supply Company has secured the contract for the rolling stock of the Brigantine Electric Railway Company, of Philadelphia, and the rails for the road are now on the ground.

The right of way for an electric road on the turnpike between Waterloo and Geneva, N. Y., has been secured, the farmers being very generous and offering the right of way almost spontaneously. It is stated that only one man wanted any consideration for his right.

In St. Louis recently the heavy frost had caused the slot through which the grip passes to the cable to contract until in places it would have been difficult to force the blade of a pen knife between the sides. An uninterrupted line of cars stretched all the way from the curve at Fourth street up to Seventeenth street. An effort was made to thaw the line out by placing burning sticks of wood along the entire length, but it was found necessary to tear up one side of the slot for more than half the distance. Several of the gripmen had attempted to force a passage, but only succeed in wedging the grip so tightly in the slot that it had to be removed.

An application to dissolve the Magneto Telegraph Company has been made in Albany before Judge Hogan and Judge Gilbert, assistants to the attorney-general, on the petition of Edwin F. Masterson, of Chicago, one of the stockholders, who alleged that the company was insolvent and had done nothing since its incorporation, several years ago. The company has a capital stock of $5,000,000, and its principal office is at Washington. It was organized under the laws of this State. The answer of the company to the application was that it was obliged to wait before doing business until the Bell patents had expired. Mr. F. B. Delehanty, of this city, appeared for the petitioner, and Mr. H. J. Loucks, of Washington, for the company.

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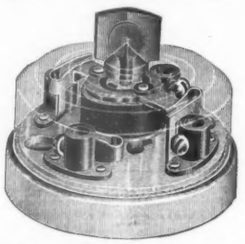

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